UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

Distr.
LIMITED
UNIDO/IS.407
16 September 1983
ENGLISH

# A SURVEY OF THE LATIN AMERICAN AGRICULTURAL MACHINERY INDUSTRY

Sectoral Studies Series
No. 6

SECTORAL STUDIES BRANCH
DIVISION FOR INDUSTRIAL STUDIES

Main results of the study work on industrial sectors are presented in the Sectoral Studies Series. In addition a series of Sectoral Working Papers is issued.

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## Preface

This study has been prepared by UNIDO's Division for Industrial Studies, Sectoral Studies Branch, with the aim of presenting a survey of the present status of and the main outlook for the Latin American agricultural machinery industry. The document will be issued as a background document for the Second Consultation Meeting on the Agricultural Machinery Industry in October 1983. It is expected that a revised version will be issued after the discussions at the Consultation Meeting.

Vienna
1983.09.13

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## EXPLANATORY NOTES

References to dollars ($) are to United States dollars, unless otherwise stated.

A comma (,) is used to distinguish thousands and millions.

A full stop (.) is used to indicate decimals.

A slash between dates (e.g., 1980/81) indicates a crop year, financial year or academic year.

Use of a hyphen between dates (e.g., 1960-1965) indicates the full period involved, including the beginning and end years.

Metric tons have been used throughout.

The following forms have been used in tables:

Three dots (...) indicate that data is not available or is not separately reported.

A dash (-) indicates that the amount is nil or negligible.

A blank indicates that the item is not applicable.

Totals may not add up precisely because of rounding.

Besides the common abbreviations, symbols and terms and those accepted by the International System of Units (SI), the following abbreviations and contractions have been used in this report:

### Economic and technical abbreviations

| | |
|---|---|
| GDP | Gross domestic product |
| HP | Horse power |
| MVA | Manufacturing value added |
| R and D | Research and Development |
| SITC | Standard International Trade Classification |
| t/a | Tons per annum |
| TCDC | Technical co-operation between developing countries |
| TNC | Transnational corporation |

## List of Abbreviations Used

ABIMAQ - Associacao Brasileira da Indústria de Máquinas e Equipamentos (Brazilian Association of the Machines and Equipment Industry)

ABRAVE - Associacao Brasileira dos Revendedores de Veículos (Brazilian Association of Motor Vehicle Dealerships)

ALADI - Asociacion Latinoamericana de Integración. Latin American Integration Association.

ANFAVEA - Associacao Nacional dos Fabricantes de Veículos Automotores (National Association of Automotive Vehicle)

BID - Banco Interamericano de Desarrollo - Interamerican Development Bank

BNDES - Banco Nacional do Desenvolvimento Econômico e Social (National Bank for Economic and Social Development)

CACEX - Carteira de Comércio Exterior do Banco do Brasil (Banco do Brasil's Foreign Trade Department)

CDI - Conselho de Desenvolvimento Industrial (Industrial Development Council)

CIEF/SRF - Coordenacao do Sistema de Informacoes Econômico-Fiscais e Secretaria da Receita Federal do Ministério da Fazenda (Economic-Fiscal Data Coordination System/Internal Revenue Department of the Ministry of Finance)

ECLA - United Nations Economic Commission for Latin America

EMBRAPA - Empresa Brasileira de Pesquisa Agrícola (Brazilian Agricultural Research Enterprise)

EMBRATER - Empresa Brasileira de Assistência Técnica e Extensao Rural (Brazilian Technical Assistance and Rural Extension Enterprise)

FIBGE - Fundacao instituto Brasileiro de Geografia e Estatística (Brazilian Institute for Geography and Statistics Foundation)

IPEA/INPES - Instituto de Pesquisas Econômicas da Secretaria de Planejamento (Economic Research Institute of the Planning Ministry-Brazil)

LAFTA - Latin American Free Trade Association

PROFIR - Programa de Financiamento para a Aquisicao de Equipamento para Irrigacao (Irrigation Equipment Acquisition Financing Program)

SUDAM - Superintendência para o Desemvolvimento da Amazônia (Superintendence for the Development of the Amazon Region)

SUDENE - Superintendência para o Desemvolvimento do Nordeste (Superintendence for the Development of the Northeast Region)

TAB - Tarifas Aduaneiras Brasileiras (Brazilian Customs Tariffs)

## Summary

This survey provides basic information on the situation of the agricultural machinery and implements industry in Latin America and a view of the development process of this branch in the region. The survey covers i.e. the development of production, the technological level, sales on internal and external markets, main constraints and obstacles, but also opportunities for the Latin American countries in this sector. On the basis of a review on national, subregional and regional levels, some conclusions and recommendations have been formulated on how to better utilize the potential and capabilities for expansion of the agricultural machinery and implements industry in Latin America.

Each Latin American country has its own characteristics, which differentiates it from the others: market size, economic development level, production structure. However, there are common features of the industry, which justify a discussion of the region as a whole. This survey tries to present these common characteristics.

The survey describes briefly the initial stages of the development of the agricultural machinery sector in Latin America. It goes on to analyse the development at national, subregional and regional levels of the sector, also the corresponding policies to promote industrial development in general and particularly the development of agricultural machinery and implements industry are briefly reviewed.

An important input to the analysis of this sector in Latin America are the agreements among Latin America countries as a result of the sectoral meetings of manufacturers of agricultural machinery held at the initiative of the Latin American Association of Integration (ALADI), former ALALC, (in English known as LAFTA). Also a very important factor in the development of this sector is the subregional agreement between the members countries of the agreement of the Andean Group Cartagena (Acuerdo de Cartagena), resulting from the Sectoral Programme of Development of the metalworking sector.

The survey describes and analyses the main factors limiting the development in Latin America of this sector, distinguishing between factors depending on the local industrial situation and factors depending on the external conditions.

Possibilities of a national, subregional, regional and international co-operation are considered.

Finally, the main opportunities for expanding this branch are evaluated and recommendations for its steady and self-supporting development are made. It is felt that this sector, because of the many dynamic aspects, can play a main part in a global strategy of the industrial development in Latin America.

# 1. Analysis of the Development of the Agricultural Machinery and Implements Industry in Latin America

## 1.1 Historical Background

Historically, the agricultural machinery and implements industry began in Argentina, a country with a long tradition as agricultural producer and exporter.

The first workshop, producing hand tools and simple agricultural implements, started approximately one century ago in the first Argentine agricultural colony, called Esperanza, in the province of Santa Fé.

With that a self-sustained development of production of agricultural machinery implements industry began in Argentina. On the basis of own and original designs, test and experiments were carried out in the fields close to the factories. Experimental laboratories allowed the pioneers of the agricultural machinery industry to create various implements, to adapt machinery to different uses, to innovate methods of farming, cultivation and harvesting, using their genius and spirit of initiative. They were the first in the world to design and manufacture the self-propelled harvester and the harvesting platform for corn, to mention some of the innovations made by the agricultural machinery and implements industry in Latin American countries.

More or less simultaneously a greatest development of the sector started in the higher developed Latin American countries: Argentina, Brazil and Mexico, and later in Colombia, Chile, Peru, Uruguay and Venezuela, beginning with the manufacture of hand tools and some simple implements and machinery.

The process of industrialization continued its evolution slowly, till the Second World War. Difficulties to import during the war stimulated an industrial production on the basis of own designs. In the post war period a massive european immigration, specially to Argentina and Brazil, gave new impulses to industry in general and to the agricultural machinery and implements industry in particular.

The first tractor factories were established in latin American countries as branches or subsidiaries of transnational corporations such as Fiat, John Deere, Massey-Ferguson, Deutz, Fahr, Hanomag, Valmet, Ford, etc. The only exception was in Argentina where a branch of the aeronautical and mechanical industry of the State, dedicated to the manufacture of airplanes, was established as a tractor industry at the beginning of the 50's, manufacturing under license the German tractor Lanz.

From 1960 to 1976 the agricultural machinery and implements industry in Latin American countries experienced a self-sustained development with high levels of growth. Thus, from 1962 to 1976 the tractors industry increased the production from 18,567 units in the first year to 100,951 units in 1976, which represented an average rate of growth of 12.9 per cent yearly; similarly the industry of agricultural machinery and implements other than tractors grew at an average of 7.0 per cent yearly in the same period.

In the last seven years (1976-1982) there has been a fall in the production level as a consequence of the international economic development and in some countries also because of internal problems. The production of tractors measured in physical units produced decreased at an average rate of 10.8 per cent yearly, and the other component of the branch decreased at an average of 9.2 per cent yearly, in both cases. (See Table 1).

Two parts of this industry are distinguished in the following, e.g.

- The manufacture of tractors

- The manufacture of other agricultural machinery and implements

Tractor manufacture is considered as a part of the automotive industry at national and regional levels, as far as capital investment regulations and industrial promotion policy is concerned.

Table 1. Production of agricultural machinery and implements in Latin America, 1962 - 1982

(units)

| Items | 1962 | 1967 | 1970 | 1976 | 1980 | 1982[a/] |
|---|---|---|---|---|---|---|
| 1. Tractors [b/] | 18,567 | 19,475 | 28,787 | 100,951 | 78,128 | 50,663 |
| of which | | | | | | |
| - Argentina | 10,981 | 9,664 | 10,642 | 24,098 | 3,658 | 3,889 |
| - Brazil | 7,586 | 6,219 | 14,029 | 65,279 | 57,975 | 32,246 |
| - Mexico | | 3,592 | 4,116 | 11,574 | 16,495 | 14,528 |
| 2. Agricultural machinery and implements other than tractors [c/] | 137,960 | 212,812 | 469,328 | 354,612 | 217,025 | 198,000 |

Sources: 1962-1980 Yearbook of Industrial Statistics-Commodity Production Data, New York, different issues.

a/ 1982: figures for tractors from national sources. For other machinery Secretariat estimates

b/ Tractors of 10 HP and over, other than industrial and road tractors.

c/ Cultivators, scarifiers, weeders, hoes, etc., harrows, ploughs, seeders, planters and transplanters, combine harvester-treshers, mowers (animal, tractor operated and sel propelled), rakes and treshing machines.

The tractor industry in Latin America has the following main characteristics:

- Tractor manufacturers are generally subsidiaries of transnational corporations or joint-venture with domestic companies working under a license system. There are a few domestic manufacturers of tractors but there is a trend to a concentration of the production to the 5 or 6 bigger companies. The strong prices competition, the capital investment requirements, marketing and research, the need of standardization, training, sales promotion, etc, has concentrated production to the large companies in the same way as the production of cars and trucks.

- The location of the industries is close to the main cities due to the need of skilled workers and labour force in general.

- The production - because of scale requirements - is mainly located to the large Latin American countries, Argentina, Brazil and Mexico.

- Generally, enterprises manufacture only one product: tractors, although in some cases the tractor factory is a separate branch of a great company that manufactures other products in the same country.

- Production is based on technology transfer from developed countries.

- Production needs large amounts of capital investment.

- Tractor manufacturing needs as a minimum 500 persons employed in the factory.

- The tractor industry needs in the Latin American countries protection through high import tariffs, import license restrictions, etc.

- There is a high degree of domestic production of components and parts, almost 100 per cent in Argentina and Brazil and a 70 per cent in Mexico.

There is a great diversification within the agricultural machinery and implements sector. Approximately 140 different machinery and implements, excluding the handtools, have been identified. This creates the need of standardization to help the exchange and to achieve economic scale in production.

Handtools and simple machinery and implements are produced in all Latin American countries except in some small countries. Tractors and self-propelled machinery as the combines and harvesters are produced to 98 per cent by the larger developed countries: Argentina, Brazil and Mexico.

This sub-sector has some characteristics which are entirely different from that of production of tractors, as e.g. the following:

- Production is located in small towns, near the farms. This fact allows for constant experiments, technical adaptation to the farmers needs and modernizations of designs of machinery, implements and accesories.

- Approximately 80 per cent of the manufacturers have less than 50 persons employed, including administrative staff, workers and technicians. Only 5 per cent of the companies have 300 to 500 total employees.

- More than 80 per cent of the manufacturers have their own designs for machinery and implements that means no technology transfer expenses.

- There is an industrial tradition in this sector. The labour force has been working in the same company for many years, some of them are in the third generation since its foundation. For example, in one enterprise in a small town, in the province of Cordoba, Argentina, more than 100 persons working are descendants of the founder's family.

- The number of manufacturers is much greater, e.g. there are in Argentina today 5 factories of tractors but approximately 600 manufacturers of other agricultural machinery and implements.

- Another important characteristic of this sector is its great versatility that permits it to adapt to different climates, different soils and different sizes of the farms and types of exploitation. In some Latin American countriees, there are different kinds of climate in a same country: tropical, sub-tropical and temperate.

- The agricultural machinery and implements with their accessories are designed in such a way that with few changes they can be used in different functions and conditions. This flexibility reduces the cost of investment for users.

From another point of view, the agricultural machinery and implements industry can be classified as:

- Mobile machinery and implements.

- Fixed or stationary machinery and implements.

There is a trend towards a greater use of the machinery and implements of fixed type, specially those used after the crop. This type of machinery has a greater development possibilities than mobile equipments.

## 1.2 The Development of Industrial Production and Foreign Trade

### 1.2.1 Industrial production

In the mid-1970's, the output of agricultural machinery in Latin America amounted to around one billion dollars of 1974, as can be seen from the statistical information provided in Table 2. The table presents statistics for the three biggest countries in the region (Argentina, Brazil and Mexico) and for four countries of the Andean Pact (Colombia, Ecuador, Peru and Venezuela) covering 90 per cent of the agricultural machinery manufactured in Latin America. The figure would not be much higher if the output of the remaining countries of the region were included, since this industry is relatively little developed in most of them.

The tractor industry represents the most important component of the agricultural machinery and implements output in Latin America. Tractors accounted for 57 per cent of the agricultural machinery produced in Argentina, 64 per cent in Brazil and in Mexico 69 per cent. The information on production of other agricultural machinery is very weak, but despite the different levels of development reached by this sector, almost all countries in the region manufacture some agricultural equipment, such as simple hand tools and some animal-drawn equipment.

Table 2. Latin America: Production of agricultural machinery in some countries in the region according to official surveys

| Country | Survey year | Thousands of 1974 dollars | Percentage % distribution |
|---|---|---|---|
| Argentina | 1973 | 260,400 | 28.2 |
| Brazil | 1974 | 510,950 | 55.4 |
| Mexico | 1975 | 127,330 | 13.8 |
| Subtotal | | 898,680 | 97.4 |
| Colombia | 1974 | 12,350 | 1.3 |
| Ecuador | 1974 | 685 | 0.1 |
| Peru | 1974 | 3,054 | 0.3 |
| Venezuela | 1974 | 7,463 | 0.8 |
| Subtotal | | 23,551 | 2.6 |
| General Total | | 922,231 | 100.0 |

Source: ECLA, Análisis de la Industria de Maquinaria Agrícola en América Latina, May 1983, p. 13.

Table 3 presents information on tractor use for Latin American countries. About twenty per cent of the tractors are in Argentina alone, and another 38 per cent in Brazil and 14 per cent in Mexico. The number of tractors in relation to cultivated area also varies sharply among different countries. Cuba emerges as the Latin American country whose agriculture is most intensively tractorized. In Costa Rica, Uruguay and Venezuela there are 10 to 15 tractors for every 1,000 ha. At the other extreme, tractor use is almost negligible in Bolivia and Haiti. Taking the region as a whole, it will be seen that tractor use is higher in Latin America than in developing regions of the world. The regional average of 5 tractors for thousand hectares of cultivated land compares with that of 1.5 tractors in Africa and 2.2 in the Far East in 1980.

Table 3. Tractor use in some Latin American countries per 1,000 ha, 1980

| Country | Cultivated area [a/] (000 ha) | Tractors in use (numbers) | Tractors per 1,000 cultivated ha |
|---|---|---|---|
| Argentina | 35,200 | 166,700 | 5.0 |
| Bolivia | 3,370 | 750 | 0.2 |
| Brazil | 61,950 | 330,000 | 5.0 |
| Chile | 5,530 | 34,600 | 6.0 |
| Colombia | 5,650 | 28,423 | 5.0 |
| Costa Rica | 490 | 5,950 | 12.0 |
| Cuba | 3,200 | 68,300 | 21.0 |
| Dominican Republic | 1,230 | 3,150 | 2.0 |
| Ecuador | 2,620 | 5,750 | 2.0 |
| El Salvador | 725 | 3,300 | 5.0 |
| Guatemala | 1,834 | 4,000 | 2.0 |
| Haití | 890 | 520 | 0.6 |
| Honduras | 1,757 | 3,250 | 2.0 |
| Mexico | 23,330 | 120,000 | 5.0 |
| Nicaragua | 1,516 | 2,200 | 1.0 |
| Panama | 574 | 4,000 | 7.0 |
| Paraguay | 1,920 | 3,200 | 2.0 |
| Peru | 3,400 | 13,900 | 4.0 |
| Uruguay | 1,910 | 28,200 | 15.0 |
| Venezuela | 3,755 | 38,000 | 10.0 |
| Total | 160,851 | 864,193 | 5.4 [b/] |

Source: FAO, Production Yearbook, 1981.

a/ Arable land and land under permanent crops.

b/ Region average.

(a) Manufacture of tractors

Table 4 gives figures for the production of tractors of over 10 HP in the region during the period 1970-1982. The production grew steadly at an average annual rate of growth of 23.6 per cent between 1970 and 1976. In 1977 the production decreased to 89,816 and in 1982 to only 50,663 units, this figure equalling the output manufactured ten years before, in 1972.

(b) Manufacture of other agricultural machinery and implements

These products are manufactured in limited quantities by medium and small enterprises and craftsmen, often in rural repair shops. The relatively simple manufacture of many tools and the advantages of being located near the market have meant that the greater part of these small manufacturers are established in agricultural areas, and accordingly more widely scattered than is usual in other branches of industry.

Production of tools for preparing the soil, sowing and cultivating, such as ploughs, rakes, sead drills, cultivators, harrows, fertilizer dispensers etc., is also quite widespread. Products of this type are made not only in Argentina, Brazil and Mexico, but also in Chile, Colombia, Ecuador, Peru, Uruguay and Venezuela.

The economic difficulties during the last two years (1981-1982) were responsible for the decrease in the production and sale levels of the agricultural machinery sector. Besides, the tractor industry is working at a very low level of capacity utilization, only 30 per cent. In 1983, the tractor production in Argentina, Brazil and Mexico has increased compared to the 1982 production and sales. Thus Argentina increased its production by 75 per cent in the first quarter of 1983 compared to the same period of 1982.

In 1982 the total tractor fleet in Latin America was 874,189 units. The big countries of the region (Argentina, Brazil and Mexico) had 70.5 per cent of the tractor stock of the region or 616,700 units.

Table 4. Latin America: Production of agricultural tractors of more than 10 horsepower, 1970-1982
(units)

| Year | Totals | Argentina | Brazil | Mexico |
|---|---|---|---|---|
| 1970 | 28,267 | 10,642 | 14,029 | 4,116 |
| 1971 | 41,895 | 13,268 | 23,548 | 5,079 |
| 1972 | 52,075 | 14,408 | 31,438 | 6,229 |
| 1973 | 68,803 | 21,460 | 41,513 | 5,830 |
| 1974 | 81,119 | 24,505 | 49,075 | 7,539 |
| 1975 | 86,540 | 18,397 | 58,061 | 10,082 |
| 1976 | 100,951 | 24,098 | 65,279 | 11,574 |
| 1977 | 89,816 | 25,631 | 53,696 | 10,489 |
| 1978 | 68,476 | 5,997 | 49,474 | 13,005 |
| 1979 | 82,819 a/ | 10,901 | 56,418 | 15,500 a/ |
| 1980 | 78,128 | 3,658 | 57,975 | 16,795 |
| 1981 | 62,832 | 1,378 | 42,474 | 18,980 |
| 1982 | 50,663 | 3,889 | 32,246 | 14,528 b/ |

Source: Years 1970-1979: United Nations Yearbook of Industrial Statistics, Vol. II, 1978. Years 1980-1982: Argentina, Ministerio de Economía, Información Económica de la Argentina, No. 126, January-February 1983. Brasil: ANFAVEA, Planejamento Económico o Estadístico, April 1983. México: Secretaría de Programación y Presupuesto, Estadística Industrial Mensual.

a/ Estimates.

b/ From January-October.

As far as harvesting equipment is concerned, the situation is rather different, because the technology is more complex. The main producer of self-propelled harvesters is Argentina, but Brazil also produces this type of machinery. Chile, Colombia and Mexico have some stationery treshing

machines. The harvester-threshers fleet in Latin America was 128,723 units and Argentina, Brazil and Mexico had a fleet of this equipment of 95,000 units, or 73,8 per cent of the region: 44,000 units in Argentina, 36,000 units in Brazil and 15,000 units in Mexico.

### 1.2.2 Foreign trade

#### (a) Import pattern

Import value at current prices of agricultural machinery in Latin America increased between 1971 and 1981, but its share in the world imports did not show any significant change. Considering the different kinds of agricultural machinery imported by the region, it can be seen that the import share of tractors (SITC 7125 Rev.1) is higher than those of other product categories - around 10%. The import share of harvesting machinery shows fluctuations over the years. The share of cultivating machinery instead has constantly decreased but reached in 1981 the level of 1975, around 7.1% (see Table 5).

#### (b) Export pattern

The export shares show a very different pattern from those of imports. In fact, the global export share of agricultural machinery increased from 0.4 percent in 1971 to 2.4 per cent in 1981. Tractors have been the most dynamic product: In 1971, Latin America exported 0.3 per cent of the world trade, increasing constantly until 1975 and reached a share of 3.5 per cent of the world tractor exports in 1981. The second item in importance is cultivating machinery which increased its share in world exports from 0.8 per cent in 1971 to 1.8 per cent in 1977 and 1.5 per cent in 1981. In the case of harvesting machinery, generally speaking, the share of around 1% has not undergone substantial changes in the years under consideration.

Table 5: Latin American Imports and Exports of Agricultural Machinery and Implements share of the of the Region in World Trade 1971 and 1975 - 1981, in constant 1975 US $millions[a]

| SITC Rev. I | Description | 1971 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|---|---|---|
| 7121/2 /5/9 | Agricultural Machinery and Implements - Total | | | | | | | | |
| | - Imports US $millions | 444.8 | 916.2 | 654.4 | 690.1 | 646.8 | 682.4 | 871.6 | 650.1 |
| | Share in world imports | 10.2 | 10.9 | 7.8 | 8.9 | 8.5 | 8.2 | 10.2 | 10.5 |
| | - Exports US$millions | 14.8 | 82.0 | 55.1 | 94.4 | 113.5 | 130.0 | 145.6 | 146.4 |
| | Share in world exporsts | 0.4 | 1.0 | 0.6 | 1.2 | 1.5 | 1.5 | 1.8 | 2.4 |
| 7121 | Cultivating Machinery | | | | | | | | |
| | - Imports US $millions | 26.9 | 51.0 | 41.6 | 35.6 | 39.6 | 47.3 | 57.0 | 48.1 |
| | Share in world imports | 8.4 | 7.2 | 6.2 | 5.3 | 6.0 | 6.4 | 7.6 | 7.1 |
| | - Exports US $millions | 2.4 | 11.9 | 9.0 | 11.8 | 9.6 | 11.7 | 13.9 | 10.1 |
| | Share in world exports | 0.8 | 1.7 | 1.4 | 1.8 | 1.5 | 1.6 | 1.6 | 1.5 |
| 7122 | Harvesting Machinery | | | | | | | | |
| | - Imports US $millions | 94.8 | 231.1 | 125.4 | 132.2 | 116.6 | 116.8 | 214.1 | 176.8 |
| | Share in world imports | 7.7 | 8.4 | 5.1 | 6.3 | 5.3 | 4.8 | 7.3 | 9.6 |
| | - Exports US $millions | 5.6 | 19.9 | 18.1 | 16.3 | 14.6 | 12.0 | 14.4 | 17.4 |
| | Share in world exports | 0.4 | 0.7 | 0.7 | 0.8 | 0.7 | 0.5 | 0.5 | 1.0 |
| 7125 | Tractors non-road | | | | | | | | |
| | - Imports US $millions | 302.6 | 603.4 | 442.2 | 484.7 | 455.6 | 467.5 | 536.4 | 396.9 |
| | Share in world imports | 13.2 | 13.7 | 9.9 | 10.9 | 9.7 | 10.9 | 11.6 | 11.9 |
| | - Exports US $millions | 6.1 | 48.4 | 26.0 | 63.5 | 84.4 | 104.0 | 114.6 | 116.8 |
| | Share in world exports | 0.3 | 1.1 | 0.3 | 1.4 | 1.8 | 2.4 | 2.5 | 3.5 |
| 7129 | Agricultural Machinery and Appliances NES b/ | | | | | | | | |
| | - Imports US $millions | 20.5 | 30.7 | 45.2 | 37.6 | 35.0 | 55.8 | 64.1 | 28.3 |
| | Share in world imports | 7.0 | 8.3 | 6.7 | 8.6 | 7.4 | 7.7 | 9.5 | 7.8 |
| | - Exports US $millions | 0.7 | 1.8 | 2.0 | 2.8 | 4.9 | 2.3 | 2.7 | 2.1 |
| | Share in world exports | 0.3 | 0.5 | 0.5 | 0.7 | 1.2 | 0.5 | 0.4 | 0.6 |

Source: UNIDO Data Bank.

a) Deflated by the Export Price Index of Agricultural Machinery and Implements, published in the Monthly Bulletin of Statistics, United Nations, New York, February 1983, p. XXX

b/ NES, Non-elsewhere specified.

(c) Total trade of agricultural machinery and implements

The importance of the tractor industry as far as its share in the world total imports and exports is concerned, corroborates the importance of the export promotion of manufactures in the most advanced developing countries of the region. The shares of imports and exports of tractors have been higher than those of total imports and exports of agricultural machinery (SITC 7121, 7122, 7125 and 7129). An analysis of the composition of the kinds of agricultural machinery products imported and exported by the region (table 6) shows that the tractor industry represents a high percentage all through. The tractor imports in the total imports of agricultural machinery has decreased from 68.0 per cent in 1971 to 61.1 per cent in 1981 whereas the tractor exports has increased from 41.1 per cent in 1971 to 70.4 per cent in 1978 and 79.8 per cent in 1981.

Total Latin American imports of agricultural machinery reached $650 million in 1981 - at constant 1975 prices, up from $445 million in 1971 (see Table 5). This represents an annual real growth rate of 3.9 per cent. Total exports rose to $146 million in 1981, up from $15 million ten years earlier, representing an annual growth rate of 25.8 per cent. Thus, although imports still exceed exports by a factor of nearly 4.5, exports grew at a much faster pace than imports. Even more remarkable is the indication that the recent recession appears to have affected imports much more severely than exports which nearly all remained in 1981 at about the 1980 levels, or even increased slightly for some product groups, whereas imports in all product categories decreased dramatically (see Table 5).

If we use the ratio

$$t^r = \frac{\text{Imports of Agricultural Machinery}}{\text{Exports of Agricultural Machinery}}$$

as an indicator, the composition of foreign trade can be analysed. A decreasing $t^r$ indicates that relatively less of the product is imported in relation to the export of the same product. An increasing $t^r$ indicates that relatively more of the product is imported.

Table 6. Composition of Latin American Imports and Exports of Agricultural Machinery and Implements in %, 1971 and 1975-1981

| SITC | Description | 1971 | | 1975 | | 1976 | | 1977 | | 1978 | | 1979 | | 1980 | | 1981 a/ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | M | E | M | E | M | E | M | E | M | E | M | E | M | E | M | E |
| 7121/22/ 25/29 | Agricultural Machinery and Implements | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| 7121 | Cultivating Machinery | 6.0 | 16.7 | 5.6 | 14.5 | 6.4 | 16.4 | 5.2 | 12.5 | 6.1 | 8.5 | 6.9 | 9.0 | 6.5 | 9.6 | 7.4 | 6.8 |
| 7122 | Harvesting Machinery | 21.3 | 37.8 | 25.2 | 24.3 | 19.2 | 32.8 | 19.2 | 17.3 | 18.0 | 12.8 | 17.0 | 9.4 | 24.6 | 9.9 | 27.2 | 11.8 |
| 7125 | Tractors non-road | 68.0 | 41.1 | 65.9 | 59.0 | 67.6 | 47.2 | 70.2 | 67.2 | 70.4 | 74.4 | 68.0 | 79.9 | 61.5 | 78.7 | 61.1 | 79.7 |
| 7129 | Agricultural Machinery NES | 4.7 | 4.4 | 3.3 | 2.2 | 6.8 | 3.6 | 5.4 | 3.0 | 5.5 | 4.3 | 8.1 | 1.7 | 7.4 | 1.8 | 4.3 | 1.7 |

Source: Table 4.

a/ Excluding Centrally-Planned Economies Countries.

The trade ratio is presented in table 7.

Table 7. Latin America: Trade ratio for Agricultural Machinery and Implements , 1971/1975-1981

| SITC | Description | 1971 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|---|---|---|
| | Total | 30.1 | 11.2 | 11.9 | 7.3 | 5.7 | 5.3 | 6.0 | 4.4 |
| 7121 | Cultivating machinery | 10.9 | 4.3 | 4.6 | 3.0 | 4.1 | 4.0 | 4.1 | 4.8 |
| 7122 | Harvesting machinery | 17.0 | 11.6 | 6.9 | 8.1 | 8.0 | 9.6 | 14.8 | 10.2 |
| 7125 | Tractors non-road | 49.9 | 12.5 | 17.0 | 7.6 | 5.4 | 4.5 | 4.7 | 3.4 |
| 7129 | Other agricultural machinery | 31.3 | 17.1 | 22.6 | 13.2 | 7.2 | 25.3 | 24.1 | 13.9 |

Source: Table 4, Secretariat estimates.

The most salient conclusion is that although Latin America remains a net importer of agricultural machinery and implements, the situation has substantially changed between 1971 and 1981. Between 1971 and 1975 the $t^r$ dropped from 30.1 to 11.2, i.e. in 1971 the region imported 30 times more than it exported agricultural machinery, in 1975 imports were 11 times higher than exports and in 1981 only 4.4 times higher. The most significant change has occured in the tractor industry with $t^r$ declining from 49.9 in 1971 to 12.5 in 1975 and to 3.4 in 1981.

We can also consider the development of a total trade ratio $(T^r)$[1/], calculated as follows:

$$T^r = \frac{\text{Exports - Imports (Agricultural Machinery and Implements)}}{\text{Exports + Imports (Agricultural Machinery and Implements)}} \times 100$$

1/ This term expresses net exports of a product as a percentage of total trade of this product in a country. A negative sign indicates net imports.

The calculation of $T^r$ for several years allows to determine to which extent changes in the trade surplus or deficit (-) depend on changes in exports or imports. The value fluctuates between a maximum of 100, signifying only exports and no imports, and a minimum of minus 100, signifying only imports and no exports.

The $T^r$ is presented in table 8.

Table 8. Latin America: Total trade ratio for Agricultural Machinery and Implements, 1971 and 1975-1981

| SITC | Description | 1971 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|---|---|---|
| | Total | -93.6 | -83.6 | -84.5 | -75.9 | -70.1 | -72.5 | -76.4 | 63.2 |
| 7121 | Cultivating machinery | -83.2 | -62.2 | -64.3 | -50.2 | -60.9 | -60.3 | -60.7 | -65.4 |
| 7122 | Harvesting machinery | -88.3 | -84.1 | -74.8 | -78.1 | -77.8 | -81.1 | -87.4 | -82.1 |
| 7125 | Tractors non-road | -96.1 | -85.1 | -88.9 | -76.8 | -68.7 | -63.6 | -64.8 | -54.5 |
| 7129 | Other agricultural machinery | -93.8 | -88.9 | -91.5 | -85.9 | -75.5 | -92.4 | -92.0 | -86.8 |

Source: Table 5, Secretariat estimates.

The high negative values of $T^r$ confirms the importance of imports of agricultural machinery and implements in Latin America. However, the $T^r$ has decreased, particularly for tractors (SITC 7125) which signifies that exports are moving faster than the imports.

A general remark should be made regarding this fast evolution of the tractor industry. In the region's import substitution policy, the tractor industry has played a very important role, particularly in countries with great potential markets such as Argentina, Brazil and Mexico. The policies adopted concist i.e. of high levels of customs protection, taxes, incentives

and policies to promote linkages industries as production of tyres, motors, spare parts, etc. In this first phase the production was for domestic use. As a second step, in the middle 60's, an outward-strategy or promotion of exports of the manufacturing sectors was initiated, which implied penetration of new markets, in the first place other countries in Latin America. This has been supported by measures such as tax incentives, arrangements through which import duties are not levied on the condition that the imported inputs are used solely in exports of final products, barter arrangements and free zones for setting up assembly industries.

A brief analysis of the exports of tractors shows that a high percentage is delivered to other Latin American countries as well as to other developing countries as shown in table 9. In fact, especially Brazil has exported tractors to developing Asia and Africa, while Argentina has concentrated its exports to other Latin American countries.

Table 9. Tractor exports from Latin America, share by regions, 1971 and 1975-1981

| | 1971 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|---|---|
| Latin America | 94.2 | 91.4 | 86.8 | 69.0 | 57.4 | 65.6 | 61.3 | 45.1 |
| Developed market economies | 5.8 | 0.7 | 5.1 | 2.5 | 16.3 | 5.0 | 13.6 | 8.1 |
| Other developing countries | - | 7.9 | 8.1 | 28.4 | 26.3 | 29.4 | 25.1 | 46.8 |

Source: UNIDO Data Bank.

There is another category of countries in Latin America other than the above mentioned which occupies an intermediate position regarding trade of agricultural machinery and implements. These countries are Venezuela and Colombia and, in some specific cases, Peru. The first two can be considered as net importers of machinery-powered equipment and tractors while, at the same time, they are important producers and exporters of implements, such as

rakes, manual cultivators, axes and the like. Colombia, in particularly, has a long tradition of exporting agricultural implements, due to its metal working facilities.

In a study carried out by UNIDO, the Export Performance Indicators for the Agricultural Machinery and Implements Industries have been calculated. Table 10 shows results of selected Latin American countries.

Table 10. Export Performance Indicators for the Agricultural Machinery and Implements Industry in selected Latin American countries

| | Share in total export of manufacturers (per cent) | | Net exports as percentage of total trade | | Export performance ratio a/ | |
|---|---|---|---|---|---|---|
| Countries | 1969-1971 | 1976-1978 | 1969-1971 | 1976-1978 | 1969-1975 | 1976-1978 |
| Argentina | 0.516 | 1.00 | -44.40 | 2.87 | 0.49 | 0.86 |
| Brazil | 0.137 | 0.91 | -89.16 | -11.68 | 0.11 | 0.82 |
| Colombia | 0.353 | 0.44 | -90.47 | -87.39 | 0.29 | 0.33 |
| Guatemala | 0.002 | 0.01 | -99.89 | -99.65 | 0.00 | 0.01 |
| Mexico | 0.069 | 0.26 | -97.79 | -77.59 | 0.06 | 0.21 |
| Nicaragua | 0.000 | 0.05 | -99.99 | -28.29 | 0.00 | 0.03 |

Source: UNIDO, Changing Patterns of Trade in World Industry, an empirical study on comparative advantage, New York, 1982.

a/ Export performance is measured by an industry's share in a given country's exports of manufactures relative to the world exports of that industry as a share of world trade in manufactures. Thus, for example, an export performance ratio of 2.0 indicates that industry's share in the given country's exports of manufacture is twice the corresponding world total.

As can be concluded from table 10, Argentina and Brazil have made a great performance in promoting exports of these products. Brazil, especially, increased the ratio more than 7 times between 1976-1978 and 1969-1971. Colombia and Mexico follow in importance while Guatemala and Nicaragua have very low performance ratios. In part, this result reflects the very limited export base of these small countries owing to their low levels of industrialization.

### 1.3 Summary of the main features of the Latin American agricultural machinery and implements industry

The development of the agricultural machinery and implements industry in Latin American is characterized by the following main features:

- Maintenance and service by various repair shops was the starting point of the industry
- Intensive use of modern farm machinery started only after World War II.
- The production of agricultural machinery and implements including tractors, had an upward trend up to 1977, interrupted during short periods due to problems outside the industry itself.
- During the period 1978-1982 growth in production declined sharply, with a trough in 1981 of production and sales.
- The production of less sophisticated implements, parts and simple pieces and handtools meets the whole domestic demand in almost all countries with the exception of some small countries in the Caribbean area.
- There is a growing inter-regional exchange of machinery, implements, parts and pieces that will allow for regional self-sufficiency also in more sophisticated products.

- The national and regional policy of import substitution in Latin American countries has played an important role in the establishment of this industry.

- Changes - and even reversals - in the policy of import substitution have caused fluctuations in the development of the sector, even to the extent that the very existence of the industry has been threatened when government support has been reduced or eliminated.

- At the end of the 1960's, new policies were introduced, at regional, subregional and national levels, to promote the expansion of the agricultural industry. If focussed on measures to promote exports, i.a. by including new products and new markets in the export activities.

- The manufacture of tractors, in most cases, works under a license system or is in the hands of subsidiaries of transnational corporations.

- The manufacture of agricultural machinery and implements - excluding tractors - uses domestic designs and technology and has reached a highly competitive level in quality and prices. The highest future capacity for the development of production, interchange and regional integration is in this part of the sector.

- In countries at a higher level of development - Argentina, Brazil and Mexico - there is a trend of using tractors of greater power, the present average in these countries being approximately 90 Hp.

- A greater use of tractors will result from a more intensive agricultural exploitation, and from extension of the cultivated area.

- There is a potential increase in the internal demand in Latin America of fixed, stationary machines and implements.

- The systems of industrial promotion of this sector are in most Latin American countries assimilated to that of capital goods or machinery and equipment for industrial use.

- In the principal countries of the region, a high level of labour skills has been reached at the industry level and at the users, maintenance and service level, similar to that of developed countries. There are some efficient official and private institutions dedicated to maintaining and improving the workers' technical skills in the area.

- In countries at a lower level of development, there is a lack of skills and training, especially at the users and maintenance shops level.

- The enormous diversification of products, users and enterprises hinder the sale and interchange at a national and regional level of products and spare parts.

- There is an urgent need for appropriate standardization measures.

## 2. Analysis of the agricultural machinery and implements industry at national, sub-regional and regional levels

There are many and great differences between Latin American countries as regards climate, soil, topography, types of agricultural production, far size, market size, development level. Therefore, there are also great differences between their respective agricultural machinery and implements industry. The main feature is the technological difference among the countries of the region. This survey presents some information about the production and the foreign trade for the three biggest countries of the region (Argentina, Brazil and Mexico) and for two countries members of the Andean Group (Colombia and Venezuela). These five countries cover approximately the 85% of the agricultural equipment manufactured in Latin America. A general overview of the description of production, imports and exports of agricultural machinery and implements by types in Latin America is presented in table 11. As can be seen, in general all the countries of the region produce handtools, but those

Table 11. Latin America: Description of Production (P), Exports (E) and Imports (M) of Agricultural Machinery and Implements Types a/

| Country | Hand tools | Hand-operated machinery | Animal-drawn equipment | Power machinery | Tractor driven implements and equipment |
|---|---|---|---|---|---|
| Argentina | P E | P E | | P E | P E |
| Bolivia | P M | M | P M | (PKD)b/ M | M |
| Brazil | P E | P E | P | P E | P E |
| Chile | P M | M | P M | M | M |
| Colombia | P E | P M | P E | M | P M |
| Costa Rica | P | | | | |
| Cuba | P | P M | P | P M | M |
| Dominican Rep. | P | M | P M | M | M |
| Ecuador | P | M | P M | M | M |
| El Salvador | P | M | M | M | M |
| Guatemala | P | M | M | M | M |
| Honduras | P | M | M | M | M |
| Mexico | P E | P E | P E | P E | P E |
| Nicaragua | P | M | M | M | M |
| Panama | P | M | M | M | M |
| Paraguay | P | P M | M | M | M |
| Peru | P | P M | M | (PKD)b/ M | M |
| Uruguay | P | M | P M | M | M |
| Venezuela | P | P M | P M | (PKD)b/ M | M |

a/ For a closer definition of the five types of Agricultural Machinery and Implements, see UNIDO/ID/96, point III, p. 42.

b/ Partly knocked down-assembly.

with more technological content are manufactured only by the big countries (Argentina, Brazil and Mexico), while there is an intermediate position for countries like Colombia and Venezuela, which produce and export some types but are net importers specially of power and tractor equipment. The small countries of Central America and Caribbean region (with the exception of Cuba) are net importers of most of the agricultural machinery and implements.

In the following sections, the situation of this subsector in selected countries will be presented.

2.1 Brazil[2/]

(a) General approach

Brazil is practically self-sufficient today in agricultural machinery (excluding tractors). The intensive development of this industrial sector started immediately after the World War II as a result of the import substitution policy.

The industry's technology - excluding tractors - is approximately to 80 per cent of domestic origin.

The spare parts industry, ancillary to the automotive industry and the various repair shops for maintenance and service of imported machinery was the starting point of this industry in Brazil. These shops reproduced the imported machinery and implements with some improvement or changes in order to adapt them to the local farmer needs.

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2/ This analysis is based on the report "Brazilian Agricultural Machinery Industry", prepared for UNIDO by Annibal V. Villela, Consultoria Econômica Ltda., Rio de Janeiro, Brazil, as well as information available from governmental sources.

As showed in Table 12 the overall production and foreign trade of the agricultural machinery and implements industry in Brazil has a very rapid development. This industry is mainly located in the southern and southeastern region.

The Brazilian manufacture of tractors started in 1960 with the production of 32 Ford units, model 8-BR, and 5 Valmet units, model 360, made by Valmet do Brazil, a subsidiary of Valmet from Finland. Afterwards, during the 1960's and 1970's until 1976, the production of this industry increased constantly with some contraction periods due to the circumstantial problems of the Brazilian economy. During the period 1977-1982 the sales contraction reduced the production. The present year, 1983, has shown a market positive reaction to the previous development.

Figure I shows the tractor production evolution in a period of 22 years, from 1960 to 1981, with a peak in 1976 of 65.327 units.

As showed in Figure II, the export evolution of farm tractors is really satisfactory, the tractor exports went from 345 units in 1973 until 10.082 in 1981, that represent 25.7 per cent of the total production in the same year. The main foreign markets for the Brazilian exports of this branch are the Latin American countries and more recently the African countries.

Regarding imports Figure III shows the evolution of the imports of tractors during the period 1972-1981. The Brazilian tractor imports showed during the first years of the 1970's an increase to a maximum of 833 units in 1975. Afterwards it showed a decreasing trend up to 1981 when not one farm tractor was imported. The State of Sao Paulo supplies the 92.8 per cent of national tractor production.

Domestic production of engine driven cultivators has been continuous by increasing with some fluctuations. The production during the period 1961-1981 reached a peak in 1980 when 6.896 units were produced as showed in Figure IV.

Table 12. Brazil: Agricultural machinery production imports and exports, 1972-1981

| YEAR | TRACTORS | | | | | ENGINE DRIVEN CULTIVADORS | | | | | HARVESTERS | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PROD | IMPORTS | | EXPORTS | | PROD | IMPORTS | | EXPORTS | | PROD | IMPORTS | | EXPORTS | |
| | | QUANT | US$ FOB | QUANT | US$ FOB | | QUANT | US$ FOB | QUANT | US$ FOB | | QUANT | US$ FOB | QUANT | US$ FOB |
| 1972 | 30,000 | 230 | 602,661 | | | 2,016 | 299 | 14,219,165 | | | 1,832 | 1,014 | 11.318.684 | | |
| 1973 | 38,756 | 258 | 810,480 | 345 | 1,520,976 | 2,985 | 1 | 3,037 | 22 | 32,089 | 3,244 | 1,096 | 13,425,599 | 25 | 321,252 |
| 1974 | 46,756 | 347 | 1,198,833 | 751 | 4,331,095 | 5,463 | 4 | 2,755 | 46 | 62,766 | 4,683 | 2,600 | 33,709,125 | 96 | 1,593,286 |
| 1975 | 59,176 | 833 | 8,372,396 | 746 | 6,041,664 | 5,606 | 3 | 783 | 101 | 126,246 | 7,448 | 2,570 | 39.269.956 | 223 | 4,793,239 |
| 1976 | 65,310 | 376 | 3,013,742 | 450 | 3.327,209 | 5,275 | 7 | 11,767 | 220 | 304.218 | 7,289 | 521 | 7,748,055 | 129 | 2,635,107 |
| 1977 | 52,566 | 107 | 2,509,430 | 4,441 | 31,325,798 | 5,394 | 1 | 9,410 | 126 | 192,166 | 5,054 | 75 | 787,727 | 240 | 5,068,542 |
| 1978 | 42,675 | 87 | 230,180 | 5,852 | 47,877,332 | 5,520 | 10 | 33,247 | 145 | 253,080 | 4,298 | 105 | 3,004,756 | 247 | 6,211,299 |
| 1979 | 52,902 | 105 | 99,378 | 6,965 | 62,578,888 | 6,230 | 15 | 4,975 | 185 | 401,725 | 4,579 | 51 | 609.731 | 310 | 8,473,887 |
| 1980 | 57,975 | 20 | 891,600 | 8,682 | 77,804,000 | 6,896 | 8 | 7,081 | 357 | 772,950 | 6,321 | 1 | 36,720 | 339 | 12,234,698 |
| 1981 | 39,209 | | | 9,082 | 107,436,000 | 4,548 | | | 179 | 439.900 | 4,852 | | | | |

SOURCE: IMPORTS - MINIFAZ/CIEF
EXPORTS - BANCO DO BRASIL/CACEX
1981 - CDI/GS-V

FIGURE I

BRAZIL
TRACTORS PRODUCTION (1960-81)

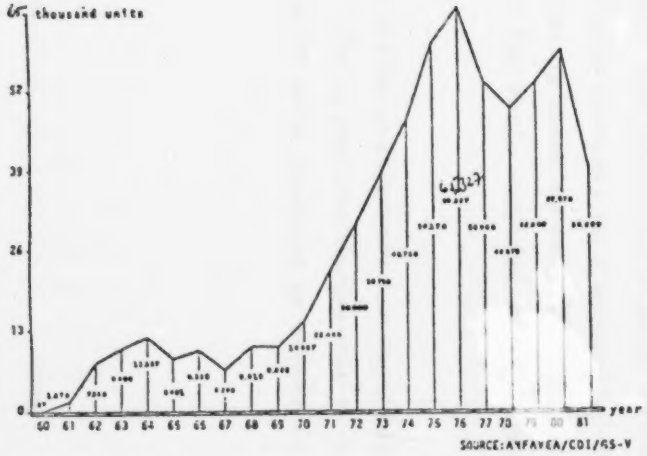
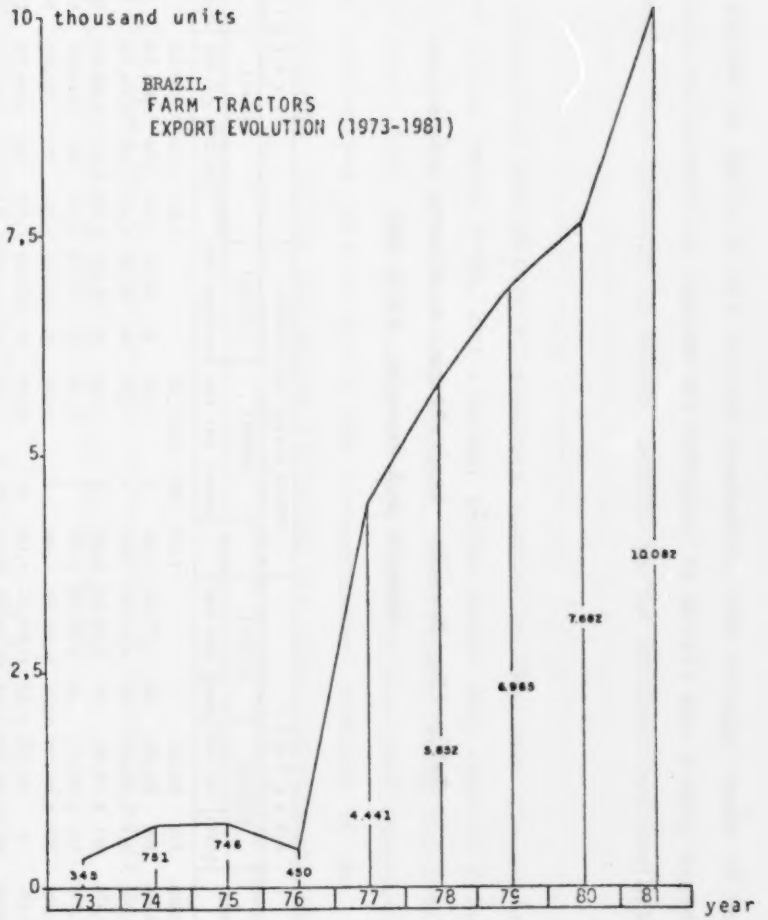


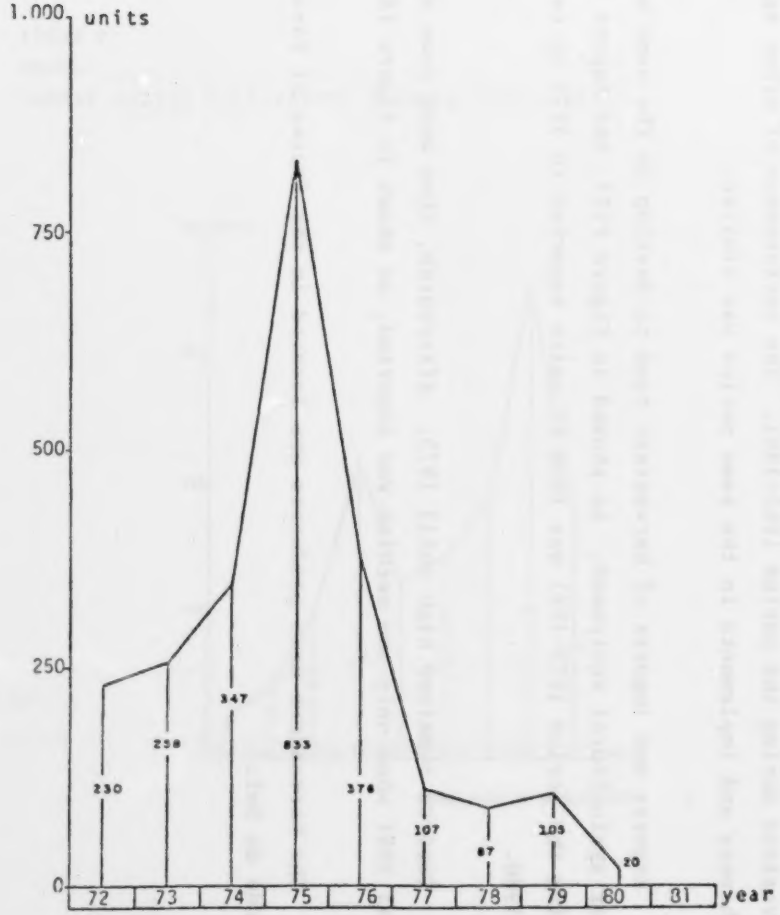

FIGURE II




SOURCE: BANCO DO BRASIL/CACEX

FIGURE III

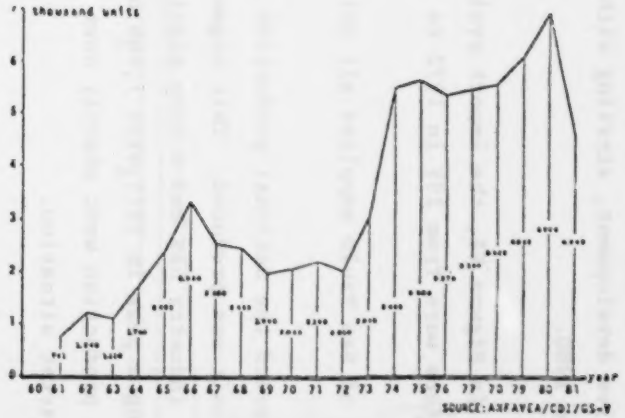
BRAZIL
FARM TRACTORS
IMPORT EVOLUTION (1972-1981)




SOURCE: MIN.FAZ/CIEF.

FIGURE IV

BRAZIL
ENGINE DRIVEN CULTIVATORS PRODUCTION (1961-1981)



The exports of the engine driven cultivators, as showed in Figure V, showed a positive development, starting with 22 units in 1973 and increasing to 347 units in 1980.

As showed in Figure VI, the import evolution (1972-1981) of the engine driven cultivators were from 299 in 1972 to only 8 machines in 1980.

The state of Sao Paulo supplies all cultivators of Brazil.

Brazil started the national production of harvesters in 1965 in which year only one unit was produced. This segment of the agricultural machinery and implements industry has had a very significant performance with fast growth, reaching a peak in 1975 with 7,448 units produced. In the period 1976-1981, the production went sharply down, with some fluctuations, following the domestic market situation.

There are six Brazilian harvester manufacturers. One of them is a local company with own designs and technology, independent on license agreements or technology transfer from foreign or transnational companies. Three of them: SLC, New Holland and Massey Ferguson produced 87 per cent of the total national production. Figure VII shows the production evolution of grain harvesters during the period 1965-1981. The performance of other agricultural machinery and implements in the same period was similar.

Exports and imports of harvesters tend to develop in the same way as other agriucltural equipment. As showed in Figure VIII, the export evolution during the period 1973-1981 was from 25 units exported in 1973 up to 339 units in 1980.

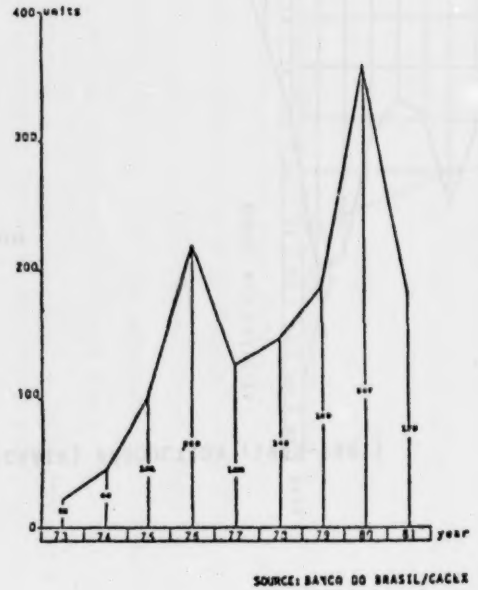
Imports remained high until 1975. Afterwards, then went down sharply until 1981 when only one machine was imported, as shown in Figure IX.

The harvesters main producers are located in the States of Parama and Rio Grande do Sul.

FIGURE V

BRAZIL

ENGINE DRIVEN CULTIVATORS EXPORTS (1973-1981)

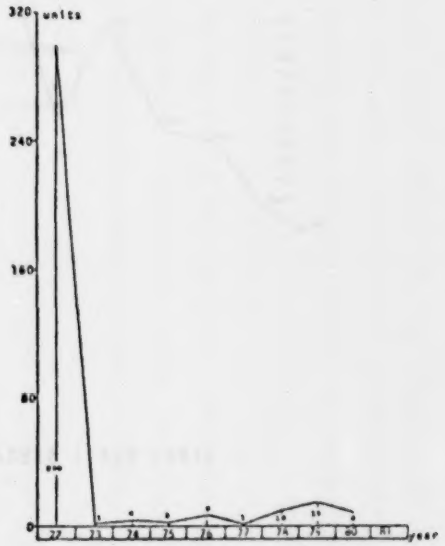



SOURCE: BANCO DO BRASIL/CACEX

FIGURE VI

BRAZIL

ENGINE DRIVEN CULTIVATORS IMPORTS (1972-1981)

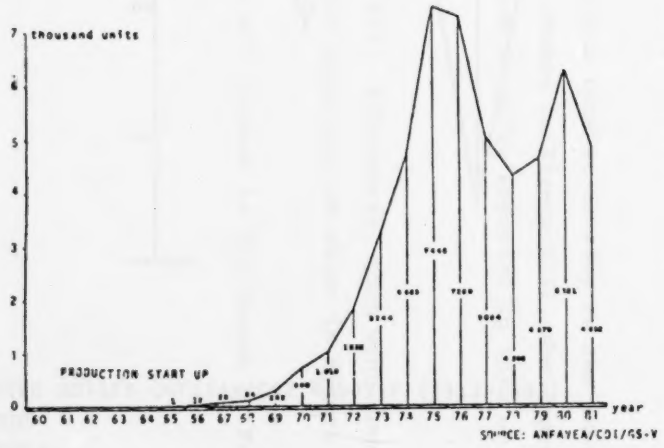



SOURCE: MIN.FAZ/CIEF

FIGURE VII

BRAZIL

HARVESTERS (GRAIN) PRODUCTION (1965-1981)




SOURCE: ANFAVEA/CDI/GS-V

FIGURE VIII

BRAZIL

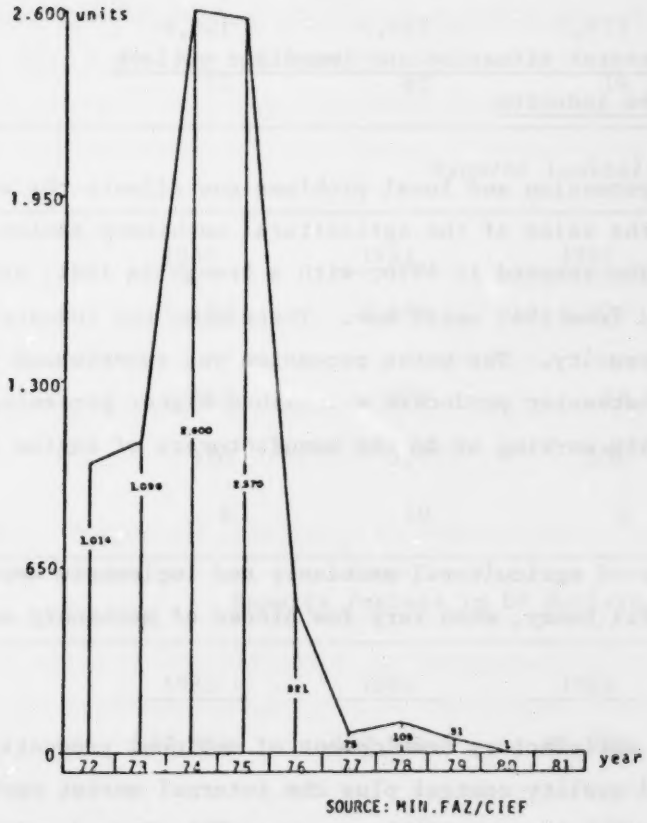
HARVESTERS EXPORTS (1973-1981)

SOURCE: CACEX

**Figure IX**

BRAZIL

HARVESTERS IMPORTS (1972-1981)




SOURCE: MIN.FAZ/CIEF

When analyzing Brazilian agricultural machinery industry promotion during the period 1980-1982, the high degree of idle capacity is obvious. In the tractor industry with a capacity installed for a production of 110,000 tractors/year, the production was 39,209 units in 1981 and 30,644 in 1982, representing respectively 64 per cent and 72 per cent idle capacity. Table 13 shows the development of production of agricultural machinery and the percentage change 1980-1982.

This segment of the industry had developed in the same way as the domestic production of other agricultural machinery. Exports of implements show a continuously increasing trend and the imports a trend to lower levels.

(b) The present situation and immediate outlook for the industry

The world recession and local problems now affects the national production and the sales of the agricultural machinery sector. The Latin American recession started in 1976, with a trough in 1981, and a slightly increasing trend from 1982 until now. Therefore, the industry has a high level of idle capacity. The worst recession was experienced in the tractor industry. The harvester producers maintain a higher percentage of their installed capacity working as do the manufacturers of engine driven cultivators.

The imports of agricultural machinery and implements decreased continuously until today, when very few pieces of machinery and implements are imported.

Due to the satisfactory development of national production, modern designs and good quality control plus the internal market recession, the export of the sector is expanding very strongly. This development is supported by national export promotion measures such as long-term export loans, international marketing studies, participation in international fairs, business missions and some special countries and regional agreements. There are very good perspectives for exports development.

Table 13. Brazil: Production (in units) and exports (units and value) of agricultural equipment 1980 - 1982

Production units

| | 1980 | 1981 | 1982 | % change 1980-1982 |
|---|---|---|---|---|
| Tractors | 57,975 | 39,209 | 30,644 | -47.1 |
| Engine driven cultivators | 6,896 | 4,548 | 5,364 | -22.2 |
| Grain harvesters | 6,321 | 4,865 | 3,423 | -45.8 |
| Sugar harvesters | 57 | 83 | 19 | -77.7 |

Exports (units)

| | 1980 | 1981 | 1982 | % change 1980-1982 |
|---|---|---|---|---|
| Tractors | 7,682 | 9,689 | 6,070 | -21.0 |
| Engine driven cultivators | 347 | 179 | 59 | -83.0 |
| Grain harvesters | 310 | 325 | 132 | -57.4 |
| Sugar harvesters | 6 | 10 | 6 | - |

Exports (values in US dollars/thousand)

| | 1980 | 1981 | 1982 | % change 1980-1982 |
|---|---|---|---|---|
| Tractors | 77,804 | 107,436 | 65,558 | -15.7 |
| Engine driven cultivators | 695 | 410 | 155 | -77.7 |
| Grain harvesters | 11,121 | 8,676 | 4,858 | -56.3 |
| Sugar harvesters | 171 | 1,125 | 778 | - |

Source: Industrial Development Council, Ministry of Industry and Trade, Brazilia, 1982.

Regarding the perspectives of the national production, the sector expects an improvement of the domestic demand due to the high priority granted to the agricultural sector in Brazil as practically all Latin American countries. The new Brazil irrigation programme - PROFIR - will promote a domestic market expansion of irrigation equipment required.

During 1983, a market upturn is expected in the sector and production is expected to increase supported by a new policy of credit for investment in agricultural industry.

In Annex I is included the most relevant statistical information for the agricultural machinery produced during the period 1974-1981 in units, as well as the agricultural machinery in operation in the years 1970 -1975 and 1980, and the agricultural machinery foreign trade.

## 2.2 Argentina[3/]

### (a) General approach

Argentina is the Latin America country which has the oldest tradition in the agricultural machinery and implements industry, because of its ideal conditions for agricultural mechanization.

This industry which started last century, is located to 90 per cent in the provinces of Buenos Aires, Cordoba and Santa Fe, where the humid "pampas" are. From the beginning until the World War II the industry enjoyed on increasing, self-sustained, growth. After the war an intensive development of the agricultural machinery industry started with the help of a national policy of imports substitution. Argentina was the world's first designer and manufacturer of self-propelled harvesters and also of the harvester platforms for corn and sunflower. Technologically speaking Argentina is self-sufficient.

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3/ This analysis is based on the report "The Status of Agro-Mechanization and of the Relevant Industry in Argentina and Identification of Training Needs", prepared for UNIDO by Baldo & C. Consulting Engineers, as well as information from governmental sources.

The agricultural machinery, implements, components and parts are practically all made at assembly plants and at plants in the cars and trucks industry.

In contrast to what has happened in the other Latin American countries, the agricultural machinery and implements industry in Argentina has been initiated by local private enterprises, former whorkshops for equipment maintenance and developed on a design basis of its own. At the begining of the 1950's, a tractor industry was established through manufacturing in "Industrias Aeronáuticas y Mecánicas del Estado". Today there are approximate 600 enterprises dedicated to the manufacture of different agricultural machinery and implements, employing approximately 30,000 persons. The annual requirements are supplied by the local production. With the exception of certain highly sophisticated equipment, Argentina can produce all agricultural machinery and implements required by the domestic agricultural sector. Traditionally, Argentina has imported very little agricultural machinery, less than 5 per cent of domestic production.

The exports of agricultural machinery reached a peak in 1975 with the amount of 40 millions US dollars, of which 27 millions US dollars consisted of tractors. Main foreign markets are other Latin American countries, specially the neighbours, Brazil, Chile, Paraguay and Uruguay and some African countries.

(b) Present situation and immediate outlook for the industry

The tractor industry in Argentina has today five plants with a production capacity of 32,000 units. The highest annual production achieved was in 1977 with 25,845 tractors which represents 85 per cent of the installed capacity. Four plants are subsidiaries of transnational corporations: Fiat, Deutz, John Deere, Massey Ferguson. The fifth one is a local enterprise named Zanello located at Las Varillas, province of Cordoba.

The Table 14 shows the evolution of tractor production and domestic sales during the period 1960-1982 and the average power of sold tractors. After a peak of productions and sales reached in 1977, both production and sales dropped sharply during period 1978-1982 as a consequence of Argentine economic policy during that period.

Table 14. Argentina, evaluation of production and power of sold tractors, 1961-1982

| Year | Production | Domestic sales | Thousand CV | Unit average |
|---|---|---|---|---|
| | (units) | (units) | | |
| 1961 | 14,338 | 16,784 | 850.2 | 50.66 |
| 1962 | 11,702 | 11,223 | 585.7 | 52.19 |
| 1963 | 11,425 | 12,096 | 621.7 | 51.40 |
| 1964 | 13,105 | 15,088 | 759.4 | 50.33 |
| 1965 | 13,568 | 13,740 | 713.7 | 51.94 |
| 1966 | 11,264 | 9,953 | 521.2 | 52.37 |
| 1967 | 9,538 | 10,535 | 576.1 | 54.58 |
| 1968 | 9,833 | 11,032 | 621.5 | 56.33 |
| 1969 | 9,003 | 9,537 | 558.2 | 58.53 |
| 1970 | 10,990 | 11,277 | 687.0 | 60.92 |
| 1971 | 15,822 | 13,749 | 872.4 | 63.45 |
| 1972 | 15,412 | 14,156 | 901.5 | 63.68 |
| 1973 | 21,306 | 18,782 | 1,192.2 | 63.47 |
| 1974 | 24,573 | 20,650 | 1,314.3 | 63.65 |
| 1975 | 18,827 | 15,210 | 1,032.9 | 67.91 |
| 1976 | 23,923 | 21,066 | 1,573.1 | 74.67 |
| 1977 | 25,845 | 21,932 | 1,657.8 | 75.56 |
| 1978 | 5,939 | 6,309 | 493.2 | 78.18 |
| 1979 | 10,610 | 7,117 | 536.4 | 75.37 |
| 1980 | 3,658 | 4,962 | 406.8 | 81.99 |
| 1981 | 1,347 | 3,054 | 275.7 | 90.28 |
| 1982 | 3,889 | | | |

Source: FIDE with data of AFAT (Asociación de Fábricas Argentinas de Tractores).

Based on an assumed average tractor life of 10 years or 10,000 work hours we can estimate the minimum annual tractor sales in the domestic market to be 13,000 units, only to maintain the same level of the tractor fleet.

The harvest year 1982/83 saw the highest cereals production in the Argentine agriculture history, 40 millions tons of cereals. The Argentine farmers increased their purchase of agricultural machinery and implements, including tractors, heavily. The four traditional tractor plants Fiat, Deutz, John Deere and Massey Ferguson sold 546 units in April 1983 with a total of 1413 units in the first four-month period of 1983 (see Table 15). This volume represented an increase of 74.6 per cent compared to same period of 1982. In these figures, sale by the local plant Zanello are not included.

Table 15. Argentina: tractors sales

January - April 1982 - 1983 (units)

| Enterprise | I. Quart 1982 | I. Quart 1983 | Percentage increase | April 1982 | April 1983 | Percentage increase |
|---|---|---|---|---|---|---|
| Deutz | 219 | 429 | 95.8 | 55 | 130 | 136.3 |
| Fiat | 136 | 295 | 116.9 | 33 | 130 | 260.6 |
| J.Deere | 244 | 213 | 12.7 | 72 | 130 | 80.5 |
| M. Ferguson | 210 | 476 | 126.6 | 55 | 167 | 203.6 |
| Total | 809 | 1,413 | 74.6 | 215 | 546 | 153.9 |

Source: El Cronista Comercial, Buenos Aires, 16 May 1983.

Sales increases are caused by the good situation in the agricultural sector. A continued increase of tractor and agriculture machinery and implements production and sales for the balance of the year is expected. A new economic policy, with soft loans for agricultural equipment investment, will further stimulate the market.

Exports of the Argentine industry to other Latin American countries have good perspectives, sales to the African region are being promoted. (See Annex II. 1).

According to market requirements average annual sales until 1985 have been estimated as showed in Annex II. 2.

The idle capacity of the tractor industry is today 75 per cent. The idle capacity of the agricultural machinery and implements is estimated to 35 per cent.

The maintenance and service of the farmer's machinery is satisfactory. Farmers are able to use the machinery and implements correctly and maintain them in good conditions. The circumstance that the agricultural machinery industry and the dealers are located close to the farms, facilities the purchase of spare parts and access to quick service and maintenance.

There are companies which provides operational services to the farmers in the use of tractors and combine-harvesters. The equipment is used very intensively practically the whole year, starting in the north and moving to south according to seasons and crops cycles. Some of these operational service companies are cooperatives but most of them are private individual companies.

## 2.3 Mexico[4/]

### (a) General approach

The future development of Mexican agriculture will depend more on its mechanization than on expansion of cultivated land, because of the high investment costs in machines.

With the exception of combine-harvesters over 100 HP, all agriculture machinery and implements is manufactured in Mexico. However, the potentially large market for the Mexican industry has not yet been fully utilized due to the lack of an adequate production planning at enterprise level.

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4/ This analysis is based on the report:"Breve Análisis Industria de Maquinaria para la Agricultura en Mexico", prepared for UNIDO by Rafael Lizarraga P. Consultant.

In 1980 the Mexican production of hand-tools was of 243 US dollars millions and the production of machinery and implements 278 US dollars millions. Exports of agricultural hand-tools, machinery and implements increased from 20 millions of US dollars in 1977 to 37 millions in 1981.

In the opinion of the Mexican manufacturers, standardization of equipment is necessary in order to reach productive scales, permitting further development and diversification of exports.

In the period of 1970-1980, the internal demand of agricultural machinery and implements triplicated, passing from 211.8 millions current US dollars in 1970 to 742.3 million US dollars in 1980.

(b) Present situation and immediate outlook for the industry

The production of agriculture and hand-tools is done in Mexico by about 40 enterprises, small and medium, which also produce other lines of hand-tools. To these factories must be added small local work-shops, for which there is not production information. The industry employed 10,000 persons in 1980.

Agricultural machinery and implements, including harvesters up to 80 HP and tractors, are exported. Self-propelled harvesters are not manufactured in the country. Mexico could theoretically manufacture 100 per cent of its need for agricultural equipment. However, actual tractors production covers only a 65 per cent. According to the National Chamber of Transformation Industry, there are 22 enterprises for the manufacture of implements. These are small and medium industries, working at an average of 70 per cent of installed capacity. In the case of agriculture machinery there are 18 manufacturers working with an average of 60 per cent of their capacity.

The tractors industry consists of five enterprises that produce 14 different models whose capacities go from 38 HP to more than 140 HP. These enterprises are associated with Ford Motor Co., International Harvester and John Deere. Siderurgica Nacional, a para-statal enterprise, produces a tractor with Russian technology. The tractor industry represents 3 per cent of the production of capital goods of the country.

349 tractors of more than 140 HP were imported in 1982, compared to a domestic production of 182 units. In 1982 the domestic production of tractors supplied 95 per cent of the total demand of 16,148 units.

The problems connected with the specialized market of small tractors (up to 50 HP) is linked to the problem of farmer size and to a lack of soft loans, supporting the mechanization of small farms, which form the most productive agriculture unities in Mexico.

In attempts to achieve a higher degree of mechanization of small farms, various ideas on organizations of productive unities into groups, associations cooperatives etc., have been launched. This has allowed for a substitution of small tractors by medium ones, since the productive areas became big enough. The use of tractors of 60 till 90 HP were feasible instead of smaller units.

The recent evolution of Mexican agriculture will positively affect the future demand of agriculture machinery and implements. It is estimated that demand will increase from 106 millions dollars in 1974, to 2,614 millions of dollars in 1990. This would result in an increase of the production of agriculture machinery and implements, probably to about 2,000 US dollars millions in 1990. The total production of this industry in 1974 was 144 US dollars millions.

On the basis of estimated development of Mexican agriculture, it is expected that the demand of tractors will increase from 20,000 units in 1980 to approx. 53,000 units in 1990, a growth rate of approx. 10 per cent/year. It is estimated that the production of tractors will increase from 17,261 units in 1980 to 52,288 in 1990.

An analysis of the composition of demand for tractors from 1970 to 1982 shows that there is no special type of tractor that could be considered suitable for all needs of the Mexican land because of the different structures of productions. This apparent requirement for a variety of tractors would imply a variety of models, requiring an expensive manufacture.

On the basis of the experience developed by the Fábrica de Tractores Agrícolas S.A., who is now the most important Mexican manufacture of tractors

and the most important leader of the market, and considering the different uses of the tractor in Mexico the future development of the market will be concentrated to tractors between 50 and 140 HP.

The following tendencies as to the structural development of demand appear likely:

(a) Tractors of 50 HP will supply less than 10 per cent of the domestic demand.

(b) Tractors of 50 to 60 HP will become more important because of the tendency of grouping of small farmers. It will represent in the future a 25 per cent of the total market.

(c) Medium tractors between 60 and 90 HP will continue to be the most important part of the market, due to its versatility and capacity (45%).

(d) Large tractors between 90 and 140 HP are estimated to cover about 20 per cent of the market.

The demand for agricultural machinery and implements can be forecast to increase from 34,600 units in 1980 to 88,000 units in 1990, an annual average increase of approximately 10 per cent/year. At the same time, the production is estimated to increase from 30,750 units in 1980 to 50,875 units in 1990. The projections of demand and production accordingly result in a deficit, which would be covered by imports. Exports of agricultural machinery and implements are estimated to increase from 4 million dollars in 1974 to 50.6 million dollars in 1990.

Annex III presents the figures on production in units and value, as well as some estimates for 1985 and 1990.

## 2.4 Colombia

### (a) General approach

Colombia's machine industry is quite large and has succeeded in meeting domestic demand for certain types of agricultural tools and machinery and even in exporting to countries in the region. Colombia does not produce tractors or any other motorized equipment such as grain or cotton harvesters.

The most important group of tools and machinery produced in Colombia consists of disc ploughs and harrows, cultivators, seed drills, especially for maize and cotton, weed cutters, lime and fertilizer distributors, flanges, ridging ploughs, fumigators, etc. In some cases, the machinery is manufactured under licence for international firms.

It should be noted that Colombia has exported agricultural tools in quite large amounts in relation to its domestic output (more than 10 per cent in 1975), mainly to other countries in the Andean Group, especially Venezuela, and also to Central America and the Caribbean countries.

The production of agricultural machinery and implements industry in Colombia is addressed to the sector of handtools and machinery and implements less sophisticated. There is also some production of animal drawn equipment and a small production of some power machinery.

Of the 20 principal producers of agricultural machinery and implements in Colombia, only two have a significant participation of foreign capital. The location of these plants, shows that this industry is located near the place where their equipment are going to be used. Regarding tractors and self-propelled machinery, specially harvesters, Colombia is a net import country. The tractor fleet of Colombia, with 22,713 units in 1970, reached 28,423 units in 1980. The 70 per cent of tractors are used in farms of more than 50 Ha. The size of Colombian farms due to its topography and type of cultivation, is relatively small if we compare it with Argentina, Brazil and Mexico.

(b) Present situation and inmediate outlook for the industry

An increase of the 12 per cent in HP for each 10 per cent in the growth of the farm size is calculated. The cost of one tractor hour is equivalent to two person/days. The average power of a tractor sold is approximately 65 HP. There is a prefeasibility study concluding that it might be possible to install a plant of tractors of 3,000 units/year and a plant of motor harvesters of 1,000 units/year.

The Andean Group through a Sectoral Programme of Development of Metalmechanic Industry, by decision 146, assigned to Colombia the following products of the sector of agricultural machinery:

- Pulverizers
- Harvesting machines
- Pasture machines
- Cultivator machines

The assignments to Colombia are shared with Venezuela. According to decision 146, their respective productions must begin at least on the end of 1984. The assignments mean that the products manufactured will have free market access, eliminating all type of restrictions and taxes to its imports in the other countries of the Andean Group. However, these assignments have not yet produced any national production.

2.5 Venezuela

(a) General approach

The evolution of tractor imports indicates a clearly trend towards growing use of self-propelled equipment in Venezuela. Venezuela has practically doubled its tractor fleet during the decade of the 1970's, passing from 19,200 units in 1970 to 38,000 units in 1980 (see table 16), indicating a major agriculture mechanization compared to other member countries of the Andean Group.

Table 16. Andean Group: Tractor Park 1970-1980

(units)

| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1980 |
|---|---|---|---|---|---|---|---|---|---|
| Bolivia | 350 | 386 | 398 | 689 | 720 | 720 | 759 | 665 | 750 |
| Colombia | 22,713 | 23,469 | 24,051 | 23,800 | 24,753 | 24,187 | 24,621 | 25,000 | 28,423 |
| Ecuador | 3,100 | 3,400 | 3,700 | 4,200 | 5,000 | 6,000 | 6,400 | 6,800 | 5,750 |
| Peru | 11,976 | 11,300 | 11,500 | 11,800 | 12,000 | 12,500 | 12,700 | 13,000 | 13,900 |
| Venezuela | 19,200 | 20,700 | 21,100 | 21,300 | 23,460 | 26,600 | 28,000 | 30,000 | 38,000 |

Source: 1978 Statistical Yearbook, United Nations.
1981 FAO Production Yearbook, Vol. 35.

Due to a lack of policy and planning of the agricultural mechanization - which is a general failure in Latin America- there is a great diversity of trade marks within the tractor fleet: Ford, Ferguson, British Leyland, Renault - David Brown - Case - John Deere - International Harvester - Caterpillar - Marshall - Perkins - Fiat etc. Given the production possibilities of Venezuela, its abundance of industrial raw materials, the extraordinary development of its iron and steel industry and of its non-ferrous metals, it is surprising that the agricultural machinery and implements industry has not become more developed.

According to an industrial survey, the production of agricultural machinery and implements in Venezuela amounted to US$ 21 millions in 1978, which was approximately 1 per cent of the total industrial production.

(b) Present situation and inmediate outlook for the industry

The enterprises are 100% Venezuelan owned. The technological level reached in the production of hand tools and agriculture implements is comparatively high.

Plans exist for a project of production of 5,500 tractors/year which has not yet been implemented. The Andean Group through its Sectoral Programme of Development of the Metalmechanic Industry and by Decision 146 assigned to Venezuela the following products of the agricultural machinery and implements industry:

- Pulverizers
- Harvesting machines
- Pasture machines
- Cultivator machines

These assignments are shared with Colombia.

2.6 Central American Countries[5/]

Most of the local production of Agricultural Tools, Machinery and Implements is limited to: hand tools such as machetes, hoes, shovels, spades, rakes, pickaxes; simple hand-operated machines such as corn shellers, chaff cutters, threshers, winnowers, and hand sprayers; animal-drawn implements such as wooden and iron plows, cultivators, harrows, seed drills, and bullock carts; and certain simple tractor-drawn equipment, power threshers and grain selectors, cleaners and driers.

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5/ This analysis is based on the report: "The Agricultural Machinery Industry in Central America", prepared for UNIDO by Alex Roca, Consultant.

Most of these are manufactured in small workshops with relatively low investment, using wood, iron and mild steel. The quality of the products is usually unreliable and the design of the products tends to be imitative without much attention to details. These products are fabricated on a made-to-order basis. The small workshops produce a variety of tools and implements as well as other metal-working products and their production is not usually shown in the countries' statistics. There are also a few large (for the region) companies which manufacture in larger quantities and provide relatively better quality products.

El Salvador is the region's largest producer of ATMI. During 1978, production reached US $4.8 million of which production of tools was 75 per cent at US $3.6 million. The production value of machetes was the largest, at US $1.9 million and 39 per cent of total production. Aggregated value in 1978 was calculated at US $3.4 million, of which US $2.5 million corresponds to agricultural tools and US $0.9 million to equipment and implements. At the present time, the ATMI industry is working at around 40% of capacity. However, there is a plan for the government of El Salvador to intervene these industries and relieve their financial situation.

Guatemala is the second largest producer of ATMI in the region, producing at only 68 per cent of El Salvador's level. Guatemalan production reached US $3.3 million in 1979 . Total production increased from US $931,660 in 1970 to US $3,327,610 in 1979, increasing 3.57 times. The machete is the only agricultural tool with significant production, with the largest production value throughout the period and contributing 66 per cent to total production. Other important production is in threshers, corn-shellers, hyskers and machinery for coffee, sugar cane and rice.

Costa Rica is a small producer of ATMI products; much of the production is in agricultural tools; also manufactured are simple machinery for rice and coffee including threshers.

There is no estimate of the accumulated total numbers of agricultural machinery or implements available for the regions as a whole. However, one study done in 1980 by Consuplan of Honduras with the co-operation of a

Swiss mission, provides some useful information on the agricultural machinery in these countries.

According to this study, in 1978 there were around 3,080 tractors, 1,903 plows, 1,991 harrows, and 559 planters in Honduras. Also there were 208 Ha per tractor: 124.6 Ha in annual crops and 83.9 Ha in permanent crops. The report shows that the small farms are heavy users of wooden plows and hammer mills while they use very few tractors, planters, cultivators and forage choppers. The few large farms--over 200 Ha in size--use almost 50 per cent of all the tractors, 42.1 per cent of the cultivators and almost 40 per cent of the forage choppers. Guatemala is known for having the largest population of tractors and implements. About half of these are of U.S. origin. Other important sources are: Great Britain, Japan, Germany, Brazil, Italy and Spain. It is important to note that there are more than 20 different brands of tractors in Central America.

The number of tractors in El Salvador was estimated for 1965 at about 1,590 units. However, due to large imports of tractors and parts since that year, this number is not particularly relevant.

## 3. National, subregional and regional policies for promotion of agricultural machinery and implements manufacture

### 3.1 National promotion policies

The Latin American countries have special incentives, financing and promotion policies. These incentives concern the whole manufacturing sector and, accordingly, also the agricultural machinery and implements industry.

In some of the Latin American countries, there is also a special system of promotion for the production of capital goods, including the sector of agricultural machinery. In the more developed countries of the region, there are specific instruments and institutions for the promotion of the agricultural machinery industry, focussing on technical assistance, training and tests of domestically produced machinery and equipment. Soft loans for industrial development are also important incentives.

Argentina, Brazil, Mexico and the member countries of the Andean Group have an exports financing policy for manufactured products. This finance promotion system has given an important stimulus to the industry.

It should be pointed out that the legislation for industrial promotion in Latin American countries has, during the past ten years, undergone many modifications, some of them affecting the structure of the policy of industrial development. These changes in legislation have caused a relative instability and even a stagnation in the process of industrial development in some countries.

In Argentina, which can be taken as a representative example, the following legislation, aiming at stimulating domestic production of agricultural machinery exists:

- Law of Industrial Promotion of 1977
  This law provides, basically, measures for reduction of/or exemption from different taxes and import duties for equipments and capital goods and reduction of/or exemption from import duties on inputs required for industrial production. The benefits of this law can be enjoyed up to 10 years after the production starts. Enterprises located within an area of 60 km around the cities of Buenos Aires, Rosario and Cordoba are excluded from these benefits.

- Law of Promotion of Industrial, Agricultural and Mining Activities of 1981
  This law has the purpose of promoting capital formation for the industrial production reducing taxes on investment.

- The Commission for the Development of Agricultural Machinery (CODEMA)
  It was created in 1978 to co-ordinate the activities of official institutions concerning the sector of agricultural machinery. This Commission is formed by the chamber of Manufacturers of Agricultural Machinery, the National Institute of Agricultural Technology (INTA) and the National Institute of Industrial Technology (INTI). This institution performs investigations for the development of the

agricultural machinery industry, tests on prototypes of new machinery and implements, establishes regulations for tests and production to standardize production, organizes technical seminars for the training and promotion of development of the agricultural machinery.

Export financing

In Argentina a system for export financing of manufactured products exists, which includes an export promotion system and financing of production awarded to the local industry through international competitive for projects financed by the Interamerican Development Bank and the World Bank or the Central Bank of Argentina. This system is applicable to the agricultural machinery and implements industry, including tractors.

There is also an export promotion system which allows for preferential exchange rates as well as a tax return on products included in a list of exports to be promoted, which includes agricultural machinery and implements.

In the case of Brazil the incentives given to farmers are, basically, the result of the domestic rural credit investment policy and of the personal income tax legislation, more specifically on the income derived from agricultural activities, which potentially encourage farmers towards higher purchases in agricultural machinery. Investment credit for example, serves a variety of purposes such, among other things, the acquisition of agricultural machinery and implements. Tractors, harvesting equipment and other agricultural machines, if not domestically produced, may only be financed if they are new and no similar products are available domestically.

Due to the excessive subsidy to the purchase of machines and equipment through government financing and the cost incurred, the rules governing credit were modified and nowadays the financial subsidies for the acquisition of machinery and implements have ceased to exist, as compared to the situation prior to 1979.

The income tax legislation has provided a very strong incentive to

agricultural activities, in general, and to the purchases of equipment in particular. This includes, for example that the expense incurred in the acquisition of a tractor may be deducted 5 times from the farmers producer's gross income. On the other hand, in the case of animal drawn vehicles, the expense incurred may only be deducted twice. This denotes a clear incentive toward the acquisition of more sophisticated equipment.

### 3.2 Subregional promotion policies

#### Andean Group

The Andean Group, consisting of Bolivia, Colombia, Ecuador, Peru and Venezuela, is the Latin American regional group that is most advanced in programming of its industries at a sectoral level. In 1972, through Decision 57 and later Decision 146, a Sectoral Programme of Development of Metalmechanic Sector was approved, the principal object of which is to promote the development of an efficient metalmechanic industry in the member countries by the creation and consolidation of a basic technological infrastructure. This will give a basis for the member countries of the Andean Group to strengthen the structure of their industrial sector, improving their capacity of adaptation to modern technology and creating possibilities of specialization, having in mind the regional interchange and other potential foreign markets.

As a part of this policy, Colombia and Venezuela have been assigned to share the manufacture of harvesting machinery, cultivators, pasturing equipment and pulverizers. These products can be sold without restrictions in all member countries and are eligible for all benefits of industrial promotion policies and soft credits. This decision is valid until the end of 1984.

### 3.3 Regional promotion policies

#### ALADI

Within the frame of the Latin American Free Trade Association (LAFTA) some meetings were held concerning various industrial sectors of Latin

America, particularly with the producers of agricultural machinery and implements of the member countries. These meetings have contributed to a better knowledge of the situation of this industrial sector in their respective countries. As result of such sectorial meetings, within the new Latin America Integration Association (ALADI), two agreements of economic complementation were approved:

(1) Agreement of Economic Complementation between Argentina and Uruguay

This Agreement has the following purposes:

(a) To intensify and diversify reciprocal commerce between both countries.

(b) To get an acceptable level of the commercial balance considering quantitative and qualitative aspects.

(c) To consider industrial activities of both countries, aiming at a greater efficiency of productive national systems and the maximum advantage of the economic scales.

(d) To stimulate investments with the purpose of achieving a better competitive capacity of both countries in regional and international markets.

(e) To promote the creation and development of binational enterprises.

To implement this agreement, each country establishes a list of products, the import of which from the partner country will be exempt of taxes and restrictions.

Argentina included in its list the following agricultural machinery that could be imported freely from Uruguay, in units by year:

| | |
|---|---|
| - Plow disc of various types (from 3 to 30 discs) | 110 |
| - Harvesters - Harvesters manure spreader | 90 |
| - Cultivator to be carried by tractor (except tractor) | 40 |
| - Steel discs for plows and harvesters and plow disc grader type | 12,000 |
| - Cattle feed harvester | 4 |
| - Equipment to select and classified grains and seeds | 5 |
| - Equipment to clear grains | 4 |

Uruguay does not have a reciprocal system of preferences towards Argentina.

(2) Agreement of Economic Complementation between Brazil and Uruguay

The list of agricultural machinery and implements of Brazil included:

- Plows (all types)
- Graders (all types of teeth)
- Extirpator
- Manure spreaders
- Planters and transplanters
- Cultivator (i.e. non-motorized)
- Cattle feed harvester, crop machinery

Uruguay grants preferences to Brazil on:

- Selector of grains and seeds
- Combine-Harvester for cereals and grains

Central America

The countries in the region do not have definite or clearly stated policies for agricultural mechanization. The primary reason for this lack of policies is the fact that the labour-saving characteristics of mechanization conflict with the goal of reducing unemployment in the agricultural sector. Nevertheless, the governments provide incentives for agricultural mechanization in many ways. They provide: 1) low import tariffs for

agricultural machinery; 2) financial loans to agriculture; 3) aid to co-operatives and the reformed sector[6/] and 4) servicing by the governments of pools of machinery and equipment.

There are two sectors where the governments are most interested in mechanization. The first is the agricultural exports ector where large increases in production are needed to solve balance of payments problems. Second is the cooperatives and the reformed sector where the governments have a political as well as social interest in the success of these farms.

Incentives to mechanization are primarily through financial loans to farmes and through low or no import tariffs for agricultural machinery and implements. Other incentives include waiver of consular fees, and in some countries, farmers who import directly pay no tariff on their imports.

Manufacturers of agricultural machinery and implements are classified as "A" industries as producers of capital goods. They have full tariff waivers on imported machinery and a percentage waiver on imported inputs of production. The length of waiver is 10 years for new industries and 6 for existing ones. These "A" industries are also exempt from paying corporate income tax--new industries for 8 years and existing industries for 2 years (extended to 4 if exporting). They are also exempt from taxes on equity and assets--10 years for new industries, 4 for existing ones.

In addition to the above general incentives, there are further incentives for exporting industries. In most cases these are not specific policies applied to the manufacture of agricultural machinery, but general policies for nontraditional exports and for import substitution industrialization. Some of these policies include trade barriers--which may include the closing of the market to competing products from non-Central American Common Market Countries, and tariffs. Production of some agricultural tools is protected by tariffs of 20 per cent and 15 per cent.

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6/ "Sector Reformado" is made up of farmers and co-operatives who obtained land through agrarian reform programmes or colonization programmes (development of new land).

4. Main factors limiting the development of the agricultural machinery and implements sector in Latin America

When analysing the causes that limit the industrial development in the Latin American region, distinctions must be made between:

- causes that are dependent on external conditions
- causes dependent on internal situation
- causes common to the most Latin American countries
- causes specific to the countries of a lower degree of development.

We do not consider here the consequences of the external economic situation.[7/] Among the causes common to the whole region are the following:

(1) The instability of the economic policies and the regulations which affect industry, production and the investment climate

(2) The lack of adequate marketing surveys

(3) The lack of adequate standardization of production

(4) The lack of adequate planning of production

(5) The lack of adequate capital investment policy

(6) The lack of adequate infrastructure of transport and communication

(7) The lack of co-operation between export producers to reduce the marketing costs.

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7/ For a more complete analysis of this point see background document "L'Industrie du Machinisme Agricole dans la Crise, Scenarios et Elements pour les Negotiations", prepared for UNIDO BY Pascal Bye and Jean-Jacques Chanaron, 1983.

(8) The instability of the local currencies in many Latin American countries, including the three more developed - Argentina, Brazil and Mexico - which has caused a continuous increase in the costs of raw materials, parts and components, affecting the final cost of machinery and implements and hindering production and trading.

(9) The short series of production - with the only exception of Brazil - which does not permit scale economies.

(10) The lack of a Latin American network of technical and commercial information on agricultural machinery and implements industry.

(11) The excessive number of manufacturers of agricultural machinery and implements and the resulting excessive number of different models of same machinery or implement.

In addition to the above mentioned causes of slow development of this industry, the following factors are selected in the less developed Latin American countries:

(12) The small market size does not permit a rentable production and the small market size does not justify the investment required to manufacture tractors and power agricultural machinery, highly dependent on scale economies.

(13) The low technological level does not permit the sophistication required to compete in the foreign markets.

(14) The dependance on import of some products, parts and components as gears, transmissions, valves, bearing, wheels, axes, pumps etc.

(15) The low horizontal integration, also due to the low development level.

(16) The monocultural structure of the agriculture production in some less developed countries hinders the product diversification and in many cases the use of agricultural implements is reduced to a few ones, due to the rigidiy of partial crops (coffee, for example).

(17) The lack of institutional technical assistance and training.

5. Main possibilities for expanding the Latin American agricultural machinery and implements industry

There is a big potential for the future development of the agricultural machinery and implements industry in Latin America due to the following main reasons:

(1) There is a serious crisis in the availability of food products, in many developing countries.

(2) Latin America, having large areas of land underutilized or not yet utilized, is the biggest land based world reserve for food production.

(3) Latin America can reach a substantial improvement in its agriculture productivity through an intensive process of agricultural mechanization.

(4) The rate of use of animal drawn power is decreasing sharply, specially in the more developed countries of the region.

(5) Governmental institutions have granted a high priority to the development of the agro-industry sector.

(6) There are in the more developed countries a high technological level, experience and capacity to export and transfer technology to the less developed countries.

(7) Regional and sub-regional agreements will promote interregional trade and horizontal integration.

(8) Packages of promotion measures, giving incentives to industrial development, exist in the Latin American countries.

(9) The institutional facilities for financing of both production and exports.

(10) The most promising cost-reducing policy in the agricultural economy is through an intensive use of agricultural machinery and implements.

In order to accelerate the development of the agricultural machinery and implements industry in Latin America, bearing in mind the main constraints which hinder the increase of its production and trading, the following recommendations could be formulated. It will be necessary:

(1) to standardize the production of agricultural machinery and implements through adequate national, regional and international co-operation; (Natural and regional institutions of technical standards together with similar institutions of the developed countries can help the sector to reach the necessary standardization)

(2) to raise the presently very low level of capacity utilization to improve true economic viability;

(3) to promote co-operation of manufacturers of agricultural machinery at national levels in order to reduce marketing costs and to have a competitive export package;

(4) to establish a Latin American network of technical and commercial information on agricultural machinery and implements industry in order to improve production and sales;

(5) to promote an adequate technology transfer to the less developed countries through international co-operation;

(6) To improve the horizontal integration through regional agreements and international co-operation; (Sectoral meetings of manufacturers can help this purpose)

(7) to promote national and regional seminars and training courses with participation of users or potential users of agricultural machinery and implements, specially in the less developed countries;

(8) to promote in the less developed countries national institutions of technical assistance in agricultural machinery, similar to those existing in the more developed countries of the region; and

(9) to make farming itself more profitable thus encouraging increased productivity through higher levels of mechanization. (This can take place through a variety of schemes such as long-term tax incentives and buy-back schemes, subsidized loans, export incentives, etc. A sensible agricultural pricing policy, however, requires political will that is often against the short-term interest of the (politically powerful) urban masses).

ANNEX I.1

## BRAZIL AGRICULTURAL MACHINERY: UNITS PRODUCED 1974-1981

( thousands)

| ITEMS | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|---|---|
| HAND OPERATED MACHINES | 272.0 | 228.0 | 362.0 | 272.0 | 451.0 | 330.6 | 322.7 | 441.6 |
| Sprayers,dusters and other similar items | 272.0 | 228.0 | 262.0 | 272.0 | 451.0 | 327.4 | 314.6 | 439.3 |
| Other hand operated machines | ... | ... | ... | ... | ... | 3.2 | 8.1 | 2.3 |
| ANIMAL-DRAWN EQUIPMENT | 15.3 | 26.1 | 49.0 | ... | ... | 44.1 | 39.8 | 3.9 |
| Ploughs | 9.0 | 13.0 | 16.0 | | | 8.6 | 1.2 | 0.5 |
| Cultivators | 6.0 | 13.0 | 33.0 | ... | ... | 34.8 | 38.6 | 3.1 |
| Sprayers | 0.3 | 0.1 | - | ... | ... | ... | ... | 0.2 |
| Other animal-drawn equipment | ... | ... | ... | ... | ... | 0.7 | 0.1 | 0.1 |
| POWER MACHINERY | 93.6 | 127.5 | 147.9 | 56.0 | 52.9 | 112.8 | 145.8 | 253.9 |
| Automotive Units | 59.6 | 71.5 | 78.9 | 56.0 | 52.9 | 75.1 | 102.3 | 71.4 |
| Self-propelled sprayers and dusters and other similar items | 2.0 | 1.0 | 4.0 | ... | ... | 9.2 | 30.3 | 22.4 |
| Self-propelled combines | 7.0 | 8.1 | 7.1 | ... | ... | 4.6 | 6.3 | 5.2 |
| Four-wheeled tractors | 46.9 | 59.2 | 65.3 | 53.0 | 48.7 | 55.2 | 58.8 | 39.3 |
| Cultivators | 3.7 | 3.2 | 2.5 | 3.0 | 4.2 | 6.1 | 6.9 | 4.5 |
| Irrigation Equipment | 34.0 | 56.0 | 69.0 | ... | ... | 37.7 | 44.5 | 182.5 |
| Sprinklers | 34.0 | 56.0 | 69.0 | ... | ... | 36.2 | 43.0 | 179.9 |
| Other irrigation equipment | ... | ... | ... | ... | ... | 1.5 | 1.5 | 2.6 |
| Components [a] | ... | ... | ... | ... | ... | 974.9 | 115.7 | 259.3 |
| TRACTOR DRIVEN EQUIPMENT | 327.6 | 348.2 | 492.6 | 92.0 | 64.0 | 715.8 | 770.8 | 516.9 |
| Tillage Equipment | 203.8 | 192.8 | 360.9 | 91.0 | 60.0 | 335.2 | 263.5 | 68.4 |
| Ploughs | 44.0 | 50.0 | 53.0 | 64.0 | 42.0 | 27.2 | 36.1 | 13.3 |
| Harrows | 48.0 | 55.0 | 95.0 | ... | ... | 40.7 | 56.4 | 31.6 |
| Ridgers | ... | ... | ... | ... | ... | 0.3 | 0.6 | 1.1 |
| Subsoilers | 2.0 | 3.0 | 2.0 | | | 2.8 | 2.1 | 3.0 |
| Cultivators | 15.0 | 19.0 | 44.8 | ... | ... | 8.8 | 14.1 | 12.5 |
| Land planes | 42.0 | 35.0 | 121.0 | 27.0 | 18.0 | 11.8 | 14.1 | 6.9 |
| Other tillage equipment | 52.8 | 30.8 | 45.1 | ... | ... | 243.6 | 140.1 | ... |
| Components [b] | ... | ... | ... | ... | ... | 879.8 | 1,581.8 | 1,261.6 |
| Seeding and Fertilizer Equipment | 21.0 | 23.0 | 19.0 | ... | ... | 235.9 | 353.6 | 324.7 |
| Fertilizer distributor | 4.0 | 6.0 | 7.0 | ... | ... | 2.1 | 2.3 | 1.7 |
| Planter-fertilizer | 17.0 | 17.0 | 12.0 | ... | ... | 10.0 | 13.8 | 10.8 |
| Fertilizer | ... | ... | ... | ... | ... | ... | ... | 0.3 |
| Planter | ... | ... | ... | ... | ... | 30.5 | 139.9 | 311.9 |

ANNEX I.1 (Cont.)

BRAZIL AGRICULTURAL MACHINERY: UNITS PRODUCED 1974-1981

( thousands)

| ITEMS | 1974 | 1975 | 1976 | 1977[c/] | 1978[c/] | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|---|---|
| Components | ... | ... | ... | ... | ... | 192.7 | 197.6 | ... |
| Plant Protection Equipment | 15.0 | 14.0 | 16.0 | ... | ... | 23.3 | 11.7 | 10.7 |
| Dusters, sprayers and other similar items | 15.0 | 14.0 | 16.0 | ... | ... | 23.3 | 11.7 | 10.7 |
| Harvesting and Threshing Equipment | 6.0 | 6.1 | 13.1 | ... | ... | 43.1 | 20.4 | 16.7 |
| Combines | 1.0 | 1.1 | 7.1 | ... | ... | 0.3 | 1.4 | 2.0 |
| Reapers | ... | ... | ... | ... | ... | 37.1 | 1.6 | 0.1 |
| Threshers | 5.0 | 5.0 | 6.0 | | | 2.7 | 13.7 | 10.1 |
| Other harvesting and threshing equipment | ... | ... | ... | ... | ... | 2.7 | 2.9 | 3.8 |
| Components | ... | ... | ... | ... | ... | 0.3 | 0.8 | 0.7 |
| Processing Equipment | 49.1 | 71.1 | 48.6 | 1.0 | 2.0 | 47.0 | 84.6 | 70.6 |
| Shellers and huskers | 0.2 | 0.2 | 0.2 | ... | ... | 0.3 | 0.4 | 0.7 |
| Grain driers | 3.0 | 1.0 | 2.0 | 1.0 | 2.0 | 2.0 | 1.0 | 1.8 |
| Milling equipment | 1.2 | 0.9 | 0.4 | ... | ... | 4.9 | 26.7 | 26.2 |
| Other processing equipment | 43.7 | 69.0 | 46.0 | ... | ... | 39.8 | 56.5 | 42.0 |
| Grain Handling Equipment | 3.0 | 5.1 | 7.0 | ... | 2.0 | 6.6 | 9.4 | 7.0 |
| Silos | ... | .... | ... | ... | 2.0 | 1.0 | 1.9 | 2.1 |
| Elevators | - | 0.1 | 5.0 | ... | ... | 2.7 | 2.1 | 2.9 |
| Other grain handling equipment | 3.0 | 5.0 | 2.0 | ... | ... | 2.1 | 4.5 | 1.0 |
| Components | ... | ... | ... | ... | ... | 0.8 | 0.9 | 1.0 |
| Transport Equipment | 29.7 | 36.1 | 28.0 | ... | ... | 24.7 | 27.6 | 18.8 |
| Trailers | 17.0 | 17.0 | 14.0 | ... | ... | 10.6 | 13.9 | 8.3 |
| Other transport equipments | 12.2 | 18.7 | 11.0 | ... | ... | 10.7 | 10.4 | 9.5 |
| Components | 0.5 | 0.4 | 3.0 | ... | ... | 3.4 | 3.3 | 1.0 |
| TOTAL OF AGRICULTURAL MACHINERY | 708.5 | 729.8 | 1,051.5 | 1,306.0 | 1,308.0 | 1,203.3 | 1,280.1 | 1,216.3 |

Sources: ABIMAQ - Brazilian Association of Machine and Equipment Industry.

a/ANFAVEA - National Association of Automotive Vehicle Producers.
This item is measured in meters, thus it is not considered with the other items.

b/This item is not included in the total since it represents a sizeable number of parts and components with a negligible unit value, but wich would distort the grand total.

c/For these years the available breakdown for the products does not allow the same presentation of the data as in the other years. However, the grand total covers all types of agricultural machinery.

ANNEX I.2 BRAZIL AGRICULTURAL MACHINERY IN OPERATION

1970, 1975 and 1980

(Census Data)

| AGRICULTURAL MACHINES | 1970 | 1975 | 1980[a/] |
|---|---|---|---|
| TRACTORS | 165,870 | 323,113 | 530,691 |
| Less than 10 hp | 19,620 | 26,773 | ... |
| 10 to 50 hp | 80,952 | 86,870 | ... |
| 50 to 100 hp | 61,554 | 188,892 | ... |
| More than 100 hp | 3,744 | 20,778 | ... |
| PLOUGHS | 1,878,925 | 2,093,960 | ... |
| Animal-drawn | 1,718,041 | 1,758,051 | ... |
| Tractor driven | 160,884 | 335,909 | ... |
| HARVESTERS (self-propelled and combines) | 98,184 | 84,707 | ... |

Sources: FIBGE, Censo Agropecuário - Brasil - 1970, Rio de Janeiro, 1975.
FIBGE, Censo Agropecuário - Brasil - 1975, Rio de Janeiro, 1979.
FIBGE, Sinopse Preliminar do Censo Agropecuário - Brasil - 1980, Rio de Janeiro, 1982.

[a/] At this writing, the only results available for 1980 were those published in the "Preliminary Synopsis of the 1980 Census", in which the item tractors was not broken down and the other figures did not appear.

ANNEX I.3

## BRAZIL AGRICULTURAL MACHINERY: FOREIGN TRADE

### EXPORTS 1970/1975 and 1978-1981

(US thousands)

| | 1970 | 1975 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|
| A- HAND TOOLS | 36.8 | 1,832.7 | 2,506.6 | 2,374.0 | 2,205.8 | 2,820.1 |
| Sickles | 5.4 | 21.7 | 87.6 | 64.3 | 78.3 | 96.1 |
| Rakers and other similar items | 0.9 | 44.4 | 9.7 | 20.5 | 24.1 | 81.3 |
| Spades, shovels and pick axes | 5.9 | 1,640.3 | 2,201.3 | 2,098.5 | 1,871.3 | 2,379.5 |
| Other hand tools | 24.6 | 126.3 | 208.0 | 190.7 | 232.1 | 273.2 |
| B- HAND OPERATED MACHINES | - | 14.7 | 1,256.9 | 1,254.1 | 1,920.5 | 2,367.1 |
| Hand pumps | ... | 14.7 | 21.7 | 33.1 | 33.8 | 137.8 |
| Dusters, sprayers and other similar items | a | ... | 1,189.8 | 1,192.7 | 1,747.4 | 2,083.5 |
| Other hand operated machine | ... | - | 45.4 | 28.3 | 139.3 | 145.8 |
| C- ANIMAL-DRAWN EQUIPMENT | 1.1 | ... | 94.4 | 140.7 | 106.6 | 81.1 |
| Ploughs | 1.1 | ... | 94.4 | 140.7 | 106.6 | 81.1 |
| D- POWER MACHINERY | | | | | | |
| D.1- Automotive Units | 247.4 | 10,961.0 | 54,341.7 | 71,640.2 | 102,106.4 | 119,020.4 |
| Self-propelled sprayers, dusters and other similar items | a/ - | ... | - | 5.7 | 19.8 | 51.8 |
| Self-propelled combines | | 4,793.2 | 6,211.3 | 8,473.9 | 12,234.7 | 16,491.0 |
| Four-wheeled micro-tractors | 247.4 | 195.6 | 537.2 | 858.4 | 321.6 | 6.7 |
| Two-wheeled tractors | | 126.2 | 253.1 | 401.7 | 778.0 | 410.8 |
| Four-wheeled tractors | | 5,846.0 | 47,340.1 | 61,900.5 | 88,752.3 | 102,060.1 |
| E- TRACTOR DRIVEN IMPLEMENTS AND EQUIPMENT | 1,065.1 | 6,418.4 | 14,791.4 | 19,106.2 | 28,694.1 | 26,446.4 |
| E.1- Tillage Equipment | 45.7 | 1,455.3 | 5,030.3 | 9,705.2 | 13,107.0 | 7,808.0 |
| Disc ploughs | - | - | 1,018.4 | 1,345.1 | 2,530.5 | 1,617.2 |
| Disc harrows | 24.3 | 1,128.2 | 3,541.9 | 7,855.6 | 8,805.3 | 4,863.2 |
| Cultivators | 21.4 | - | 242.6 | 192.6 | 171.3 | 367.6 |
| Other ploughs | - | - | 147.2 | 229.6 | 507.2 | 429.4 |
| Other harrows | - | - | - | - | 58.9 | 69.7 |
| Other tillage equipment | - | 238.5 | 80.2 | 82.3 | 1,033.8 | 1,892.6 |
| E.2- Seeding and Fertilizer Equipment | 149.8 | 1,834.6 | 1,888.4 | 3,040.1 | 4,954.2 | 5,815.3 |
| Fertilizer distributors | - | 14.6 | 6.0 | 41.3 | 341.8 | 351.7 |
| Planter or Planter-fertilizer distributor | 139.1 | 927.9 | 273.7 | 1,485.4 | 1,471.8 | 2,266.6 |
| Components | 10.7 | 647.2 | 453.5 | 799.5 | 1,825.6 | 1,732.7 |
| Other seeding and fertilizer equipment | - | 244.9 | 437.3 | 713.9 | 1,315.0 | 1,464.3 |
| E.3- Plant-Protection Equipment | a | ... | 4,174.3 | 3,551.1 | 4,610.9 | 3,894.0 |
| Dusters, sprayers and other similar items | a | ... | 3,434.3 | 2,648.9 | 3,229.5 | 2,898.3 |
| Other plant-protection equipment | a | ... | 740.0 | 902.2 | 1,381.4 | 995.7 |
| E.4- Harversting and Threshing equipment | 869.6 | 2,831.5 | 2,983.9 | 1.548.6 | 2,666.3 | 5,869.4 |
| Combines | 27.1 | 315.3 | 339.8 | 278.2 | 611.6 | 1,301.3 |
| Reapers | 6.9 | 4.4 | 76.4 | 35.4 | 93.7 | 352.3 |
| Components | 14.0 | 230.4 | 447.1 | 525.5 | 1,043.6 | 2,013.7 |
| Other harvesting and threshing equipment | 821.6 | 2,331.4 | 2,120.6 | 709.5 | 917.4 | 2,202.1 |

ANNEX I.3(Cont.) BRAZIL AGRICULTURAL MACHINERY: FOREING TRADE

EXPORTS 1970/1975 and 1978-1981

(US thousands)

| | 1970 | 1975 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|
| E.5- Processing Equipment | - | 247.0 | 714.5 | 1,261.2 | 3,355.7 | 3,059.7 |
| Grain selectors | - | 104.1 | 377.8 | 696.8 | 2,231.0 | 904.2 |
| Other processing equipment | - | 142.9 | 336.7 | 564.4 | 1,124.7 | 2,155.5 |
| TOTAL OF AGRICULTURAL MACHINERY | 1.425.9 | 19,226.8 | 72,991.0 | 94,515.2 | 135,033.4 | 150,735.1 |

Source: CACEX/Banco do Brasil, Brasil, Comércio Exterior - Exportação, Rio de Janeiro, for various years.

a/ In the case of sprayers, dusters and other similar items, the information available for 1970 could not be brokendown into hand operated, animal-drawn and self-propelled categories. It is known that its total imports reached US$ 1,022 thousand and its exports US$ 75 thousand in the year 1970.

ANNEX I.4 BRAZIL AGRICULTURAL MACHINERY: FOREIGN TRADE
IMPORTS 1970/75 and 1978-1981

(US thousands)

| | 1970 | 1975 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|
| A- HAND TOOLS | 213.6 | 876.3 | 300.1 | 328.6 | 289.6 | 144.4 |
| Sickles | 69.0 | 68.3 | 4.5 | 4.7 | 3.4 | 7.0 |
| Rakers and other similar items | 1.6 | 15.7 | 20.8 | 43.0 | 1.3 | 0.3 |
| Spades, shovels and pick axes | 0.9 | 82.2 | 5.8 | 2.7 | 4.6 | 0.9 |
| Other hand tools | 142.1 | 264.6 | 269.0 | 278.2 | 280.3 | 136.2 |
| B- HAND OPERATED MACHINES | - | 455.5 | 412.9 | 339.9 | 198.6 | 278.5 |
| Hand pumps | ... | 379.6 | 131.6 | 134.6 | 108.0 | 131.2 |
| Dusters, sprayers and other similar items | a | 65.4 | 274.0 | 205.3 | 90.6 | 142.2 |
| Other hand operated machine | ... | 0.5 | 7.3 | - | - | 5.1 |
| C- ANIMAL-DRAWN EQUIPMENT | 0.7 | - | - | - | - | - |
| Ploughs | 0.7 | - | - | - | - | - |
| D- POWER MACHINERY | | | | | | |
| D.1- Automotive Units | 11,877.4 | 52,240.1 | 3,526,4 | 803.7 | 970.1 | 105.2 |
| Self-propelled sprayers, dusters and other similar items | a/ | 5.8 | 285.3 | 89.6 | 34.8 | - |
| Self-propelled combines | 11,750.7 | 43,861.1 | 3,004.8 | 609.7 | 36.7 | 64.7 |
| Four-wheeled micro-tractors | | 31.8 | 22.1 | - | 1.6 | 37.1 |
| Two-wheeled tractors | 126.7 | 0.8 | 33.2 | 5.0 | 7.0 | 3.4 |
| Four-wheeled tractors | | 8,340.5 | 181.0 | 99.4 | 890.0 | - |
| E- TRACTOR DRIVEN IMPLEMENTS AND EQUIPMENT | 1,383.9 | 12,383.7 | 2,638.4 | 3,813.6 | 7,107.3 | 3,849.1 |
| E.1- Tillage Equipment | 250.2 | 224.9 | 93.7 | 21.1 | 53.2 | 6.5 |
| Disc ploughs | - | 6.3 | - | 2.8 | 0.4 | 1.6 |
| Disc harrows | 14.5 | 115.1 | 16.1 | 11.3 | 0.7 | - |
| Cultivators | - | 85.9 | 61.2 | 4.9 | 9.0 | 2.4 |
| Other ploughs | 2.1 | 4.3 | 12.6 | 0.3 | 17.6 | 1.5 |
| Other harrows | - | - | - | - | - | - |
| Other tillage equipment | 233.6 | 13.3 | 3.8 | 1.8 | 25.5 | 1.0 |
| E.2- Seeding and Fertilizer Equipment | 258.9 | 1,508.4 | 756.5 | 878.3 | 736.6 | 622.9 |
| Fertilizer distributors | 40.4 | 94.7 | 17.0 | 22.5 | 12.7 | 1.4 |
| Planter or Planter-fertilizer distributor | 164.5 | 273.7 | 991.6 | 36.8 | 107.8 | 13.6 |
| Components | 36.4 | 369.8 | 434.0 | 404.3 | 414.5 | 426.1 |
| Other seeding and fertilizer equipment | 17.6 | 770.2 | 248.7 | 414.7 | 201.6 | 181.8 |
| E.3- Plant-Protection Equipment | - | 1,076.1 | 95.6 | 550.3 | 2,034.5 | 502.4 |
| Dusters, sprayers and other similar items | a | 669.4 | 95.6 | 259.4 | 2,007.2 | 367,5 |
| Other plant-protection equipment | a | 406.7 | - | 290.9 | 27.3 | 134.9 |
| E.4- Harversting and Threshing equipment | 874.8 | 9,368.4 | 1,610.3 | 1,808.4 | 4,144.7 | 2,611.1 |
| Combines | n.a. | 1,401.8 | 82.5 | 141.5 | 23.9 | 69.5 |
| Reapers | 181.6 | 1,556.7 | 373.9 | 351.2 | 720.1 | 295.9 |
| Components | 606.6 | 4,699.7 | 796.5 | 908.9 | 2,811,3 | 1,861.6 |
| Other harvesting and threshing equipment | 86.6 | 1,700,2 | 357.4 | 405.8 | 589.4 | 384.1 |

ANNEX I.4 (Cont.) BRAZIL AGRICULTURAL MACHINERY: FOREIGN TRADE
IMPORTS 1970/75 and 1978-1981
(US thousands)

| | 1970 | 1975 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|
| E.5- Processing Equipment | - | 205.9 | 82.3 | 555.5 | 138.3 | 106.2 |
| Grain selectors | - | 150.9 | 50.9 | 241.7 | 125.4 | 84.4 |
| Other processing equipment | - | 55.0 | 31.4 | 313.8 | 12.9 | 21.8 |
| TOTAL OF AGRICULTURAL MACHINERY | 14,498.1 | 65,945.6 | 6,877.8 | 5,285.8 | 8,565.6 | 4,377.2 |

Source: CIEF/SRF/Ministry of Finance, Comércio Exterior do Brasil - Importações, Brasília, for various years.

a/ In the case of sprayers, dusters and other similar items, the information available for 1970 could not be brokendown into hand operated, animal-drawn and self-propelled categories. It is known that its total imports reached US$ 1,022 thousand and its exports US$ 75 thousand in the year 1970.

ANNEX II.1 EXPORT OF ARGENTINA MADE TRACTORS
(UNITS)

| YEARS | EXPORTS | DOMESTIC SALES | TOTAL SALES | PERCENTAGE SHARE OF EXPORT OF TOTAL SALES |
|---|---|---|---|---|
| 1961 | 1 | 16.783 | 16.784 | - |
| 1962 | 0 | 11.223 | 11.223 | - |
| 1963 | 6 | 12.128 | 12.134 | - |
| 1964 | 17 | 15.071 | 15.088 | 0,1 |
| 1965 | 6 | 13.734 | 13.740 | - |
| 1966 | 10 | 10.019 | 10.029 | 0,1 |
| 1967 | 9 | 10.546 | 10.555 | 0,1 |
| 1968 | 35 | 10.997 | 11.032 | 0,3 |
| 1969 | 98 | 9.439 | 9.537 | 1,0 |
| 1970 | 272 | 11.004 | 11.276 | 2,4 |
| 1971 | 1.087 | 13.749 | 14.836 | 7,3 |
| 1972 | 710 | 14.156 | 14.866 | 4,8 |
| 1973 | 2.741 | 18.782 | 21.523 | 12,7 |
| 1974 | 4.233 | 20.650 | 24.883 | 17,0 |
| 1975 | 3.831 | 15.210 | 19.041 | 20,1 |
| 1976 | 1.786 | 21.063 | 22.849 | 7,8 |
| 1977 | 1.810 | 21.932 | 23.742 | 7,6 |
| 1978 | 2.752 | 6.309 | 9.061 | 30,4 |
| 1979 | 2.944 | 7.117 | 10.061 | 29,3 |
| 1980 | 818 | 3.481 | 4.299 | 19,0 |

SOURCE AFAT, Exportaciones 1961-1967 INDEC.

Argentina

Average annual requirements for the principal agricultural machines and implements (1981-1985)

| Category I | Implements [a] |
|---|---|
| Steel shovels | 700,000 |
| Shovels and small shovels, miscellaneous | 40,000 |
| Shovels for transplanting | 10,000 |
| Thistle-cutters | 1,000 |
| Hoes | 70,000 |
| Rakes | 120,000 |
| Axes | 60,000 |
| Weeders | 130,000 |
| Pruning shears | 300,000 |
| Harvesting shears | 25,000 |
| Small pruning axes | 25,000 |
| Picks | 70,000 |
| **Category II** | **Intermediate machinery** |
| Mouldboard ploughs | 8,000 |
| Disc ploughs | 12,000 |
| Harrow ploughs | 3,000 |
| Ploughs, miscellaneous | 500 |
| Disc harrows | 6,000 |
| Tooth harrows | 14,000 |
| Rotary harrows | 1,000 |
| Harrows, miscellaneous | 600 |
| Sprayers | 7,000 |
| Hillers | 600 |
| Cultivators | 1,500 |
| Mowers | 1,500 |
| Rotary cutters | 2,500 |
| Windrowers | 900 |
| Seed drills, fine-grain | 3,000 |
| Seed drills, coarse-grain | 5,000 |
| Seed drills, broadcast with seed hopper | 3,500 |
| Seed hoppers, miscellaneous | 3,500 |
| Dusters | 1,000 |
| Trailers, miscellaneous | 4,000 |
| Platforms, miscellaneous | 3,000 |
| Windmills | 10,000 |
| Silos, miscellaneous | 3,000 |
| **Categories III and IV** | **Powered machinery and specialized equipment** |
| Tractors | 26,000 |
| Internal-combustion engines | 100,000 [b] |
| Water pumps | 18,000 |
| Pumps, miscellaneous | 5,000 |
| Combine harvesters, self-propelled, for grains | 3,000 [c] |
| Combine harvesters, self-propelled, special | 300 |
| Combine harvesters, not self-propelled, miscellaneous | 1,000 |
| Windrowers, self-propelled | 100 |
| Grain dryers, stationary and portable | 300 |
| Milking machines, mechanical | 2,000 |
| Forrage choppers, combined, self-propelled | 50 |
| Trailers for transporting agricultural machinery | 200 |

Source: ID/WG.330/28 p.4 and 5

[a] For agricultural and other uses.

[b] These engines are used for agricultural purposes and in all types of industry except the motor industry.

[c] Includes combines for marshland, rice, sugar cane, etc.

ANNEX III.1 MEXICO: Gross Value of Production of Agricultural Machinery and Implements 1970-1978

(US thousands)

| | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|---|---|---|---|---|---|---|---|---|---|
| gricultural hand-ools | 77.0 | 89.6 | 104.0 | 120.8 | 140.0 | 162.6 | 183.9 | 207.9 | 243.4 |
| mplements and gricultural machinery | 71.4 | 92.0 | 120.8 | 128.8 | 144.0 | 169.9 | 200.5 | 236.5 | 277.8 |
| mps and compressors | ... | ... | ... | ... | 69.6 | 88.7 | ... | ... | 127.1 |
| T A L | 148.4 | 181.6 | 244.8 | 249.6 | 353.6 | 421.2 | 383.4 | 444.4 | 648.3 |

Source: Sistema de Cuentas Nacionales de Mexico, Secretaria de Programacion y Presupuesto Energo/1981

ANNEX III.2 MEXICO: Internal Demand of Handtools, Implements and Agricultural Machinery 1971-1980

(US thousands)

| | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|
| gricultural hand-ools | 117.7 | 131.0 | 149.4 | 166.0 | 185.9 | 208.2 | 233.1 | 261.1 | 292.5 | 327.6 |
| mplements and gricultural machinery | 118.4 | 149.4 | 148.4 | 199.6 | 235.3 | 263.5 | 295.1 | 330.6 | 370.2 | 414.7 |
| O T A L | 236.1 | 280.4 | 297.8 | 365.6 | 421.2 | 471.7 | 528.2 | 591.7 | 662.7 | 742.3 |

Source: NAFINSA, Capital Goods Project, Mexico.

ANNEX III.3 MEXICO: Sales of Combine-harvesters by enterprises 1978-1981

(in units)

| ENTERPRISE | UNITS | | | |
|---|---|---|---|---|
| | 1978 | 1979 | 1980 | 1981 |
| JOHN DEERE | 306 | 293 | 265 | 240 |
| NEW HOLLAND | 59 | 59 | 42 | 0 |
| INTERNATIONAL HARVESTER | 36 | 29 | 25 | 30 |
| MASSEY FERGUSON | 68 | 46 | 29 | 35 |
| ALLIS CHALMERS | — | 30 | 40 | 80 |
| T O T A L | 469 | 457 | 401 | 385 |

Source: Consultants Report, Mexico

ANNEX III.4 MEXICO: Demand and Production Projections of Tractors and Agricultural Implements 1980-1990

(Units)

TRACTORS

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DEMAND | 21,663 | 24,031 | 26,494 | 29,055 | 31,718 | 34,488 | 37,833 | 41,464 | 45,445 | 49,808 | 54,589 |
| PRODUCTION | 17,261 | 21,875 | 26,469 | 30,439 | 35,005 | 40,256 | 42,417 | 44,695 | 47,095 | 49,624 | 52,288 |
| DIFFERENCE | -4,402 | -2,156 | - 25 | -1,384 | 3,287 | 5,768 | 4,584 | 3,231 | 1,650 | - 184 | -2,301 |

AGRICULTURAL IMPLEMENTS

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DEMAND | 34,660 | 38,449 | 42,390 | 46,488 | 50,740 | 55,180 | 60,532 | 66,342 | 72,728 | 79,692 | 87,342 |
| PRODUCTION | 30,750 | 32,262 | 34,068 | 35,873 | 37,679 | 39,485 | 41,538 | 43,698 | 45,970 | 48,360 | 50,875 |
| DEFICIT | -3,910 | -6,187 | -8,322 | -10,615 | -13,061 | -15,695 | -18,994 | -26,758 | -26,758 | -31,332 | -36,467 |

Source: SECRETARIA DE PROGRAMACION Y PRESUPUESTO,

DIRECCION GENERAL DE ANALISIS DE RAMAS ECONOMICAS.

## ANNEX IV

Country case studies used for this report

| | |
|---|---|
| Argentina | The Status of Agro-Mechanization and of the Relevant Industry in Argentina and Identification of Training Needs, by Baldo & C. Consulting Engineers, 1983. |
| Brazil | Brazilian Agricultural Machinery Industry, by Annibal V. Villela, Managing Partner, Annibal Villela Consultoria Econômica Ltd., Rio de Janeiro, Brazil, 1983. |
| Mexico | Breve Análisis Industria de Maquinaria para la Agricultura en México, by Rafael Lizarraga P. Consultant, 1983. |
| Andean Group | -La Mecanización Agrícola en Venezuela - Diagnóstico global, problemas y perspectivas, by Mario Reyes Ch.Consultant, 1983. |
| | -La Mecanización Agrícola en Colombia - Diagnóstico global, problemas y perspectivas, by Mario Reyes Ch. Consultant, 1983. |
| | -Case study for Bolivia, Ecuador and Peru, by Mario Reyes Ch. Consultant, 1983. |
| ECLA | Analisis de la Industria de Maquinaria Agrícola en América Latina. CLT/83-110, Mayo 1983, by Liborio Bustos. |
| Central America | The Agricultural Machinery Industry in Central America, by Alex Roca, Consultant, 1983. |